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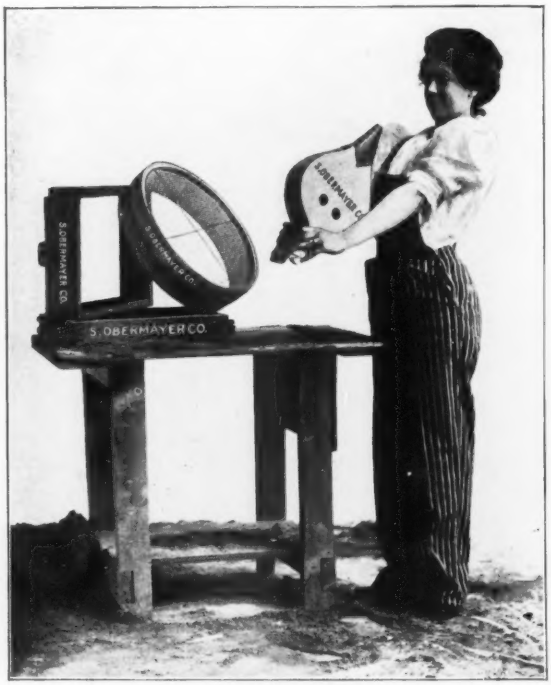

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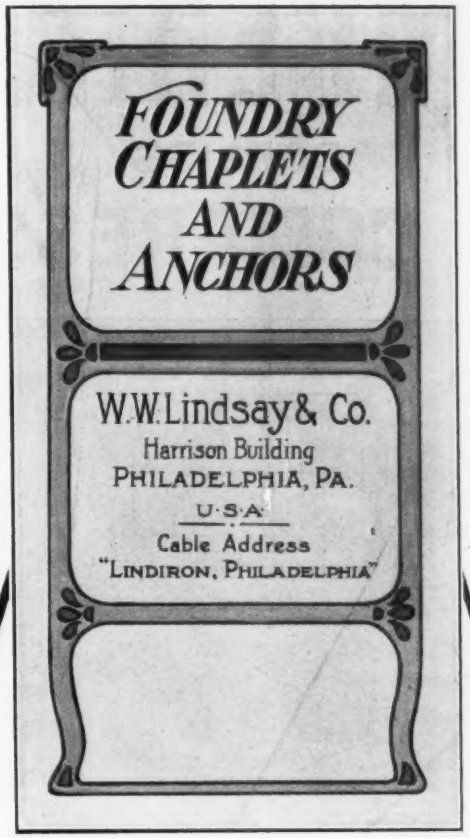

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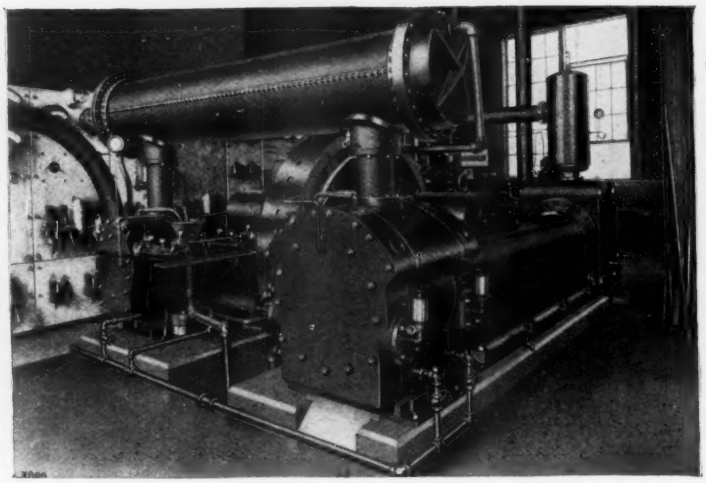

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INCREASE YOUR DIVIDENDS

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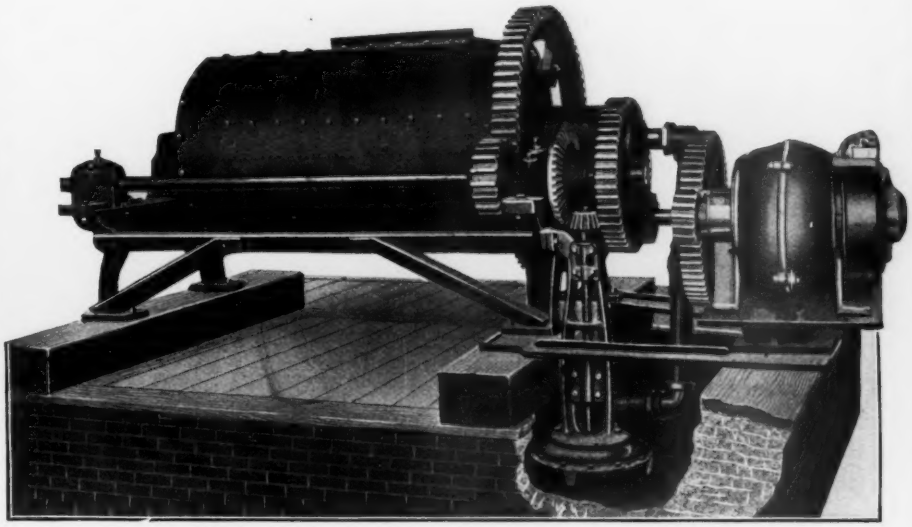

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We build both Motor and belt driven Mills.

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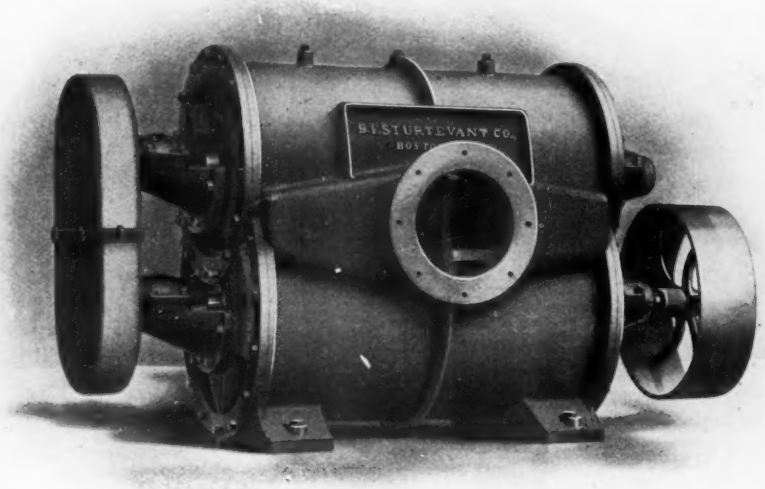
Manufacturers of Foundry Appliances

Send for our catalog if you have not received a copy.

In the Sturtevant High Pressure Blower

there can be no harmful leakage after years of use. The bearings are always in perfect alignment. There is no possibility of interference between the rotors and no friction losses due to their rubbing together.

Bulletin No. 127 describes it.



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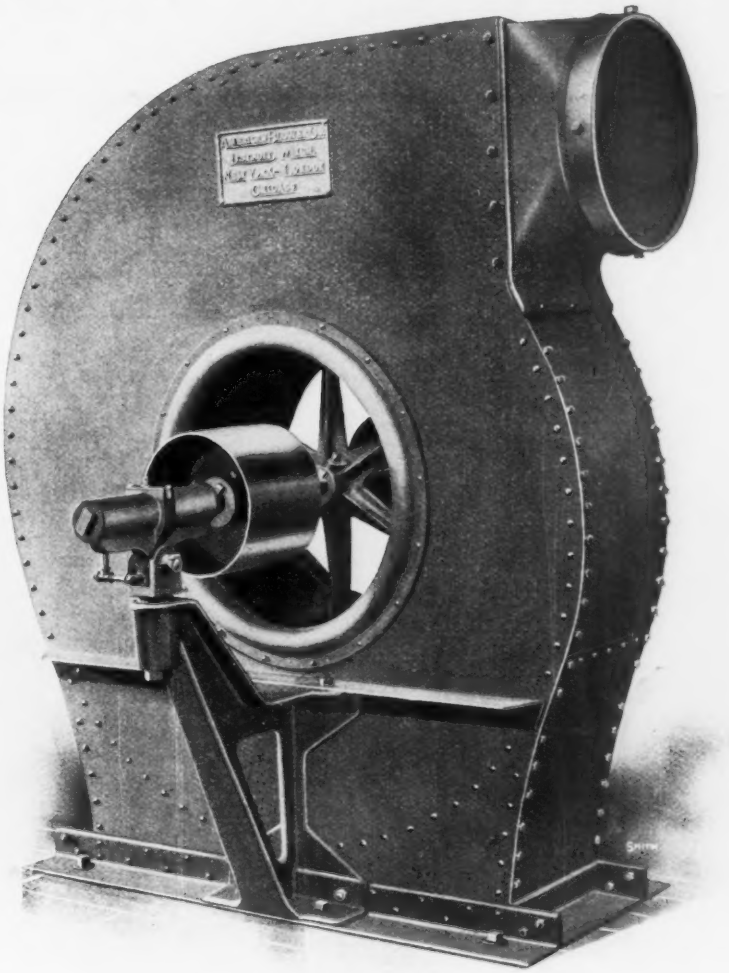
Designers and Builders of Heating, Ventilating, Drying and Mechanical Draft Apparatus; Fans, Blowers and Exhausters; Steam Engines, Electric Motors and Generating Sets; Fuel Economizers; Forges, Exhaust Heads, Steam Traps, Etc.

607

"ABC" Steel Pressure Blowers



The **Blast Wheel** is one of the most important factors in the construction of a Pressure Blower. In the "ABC" the blast wheel is made up of a tough and strong malleable iron spider, and a selected quality of sheet steel. The rivets are of a special grade and the riveting is done in a most careful manner. The wheel is then trued up and balanced in a special balancing machine, being tested for balance up to nearly double the speed it will regularly have to run.

It is only in this careful and thorough manner of constructing and testing that the purchaser can be assured of a perfectly smooth and safe machine at the high speeds demanded in the class of work to which these Blowers are applied.

Ask for new Catalogue No. 190-A

AMERICAN BLOWER CO.,

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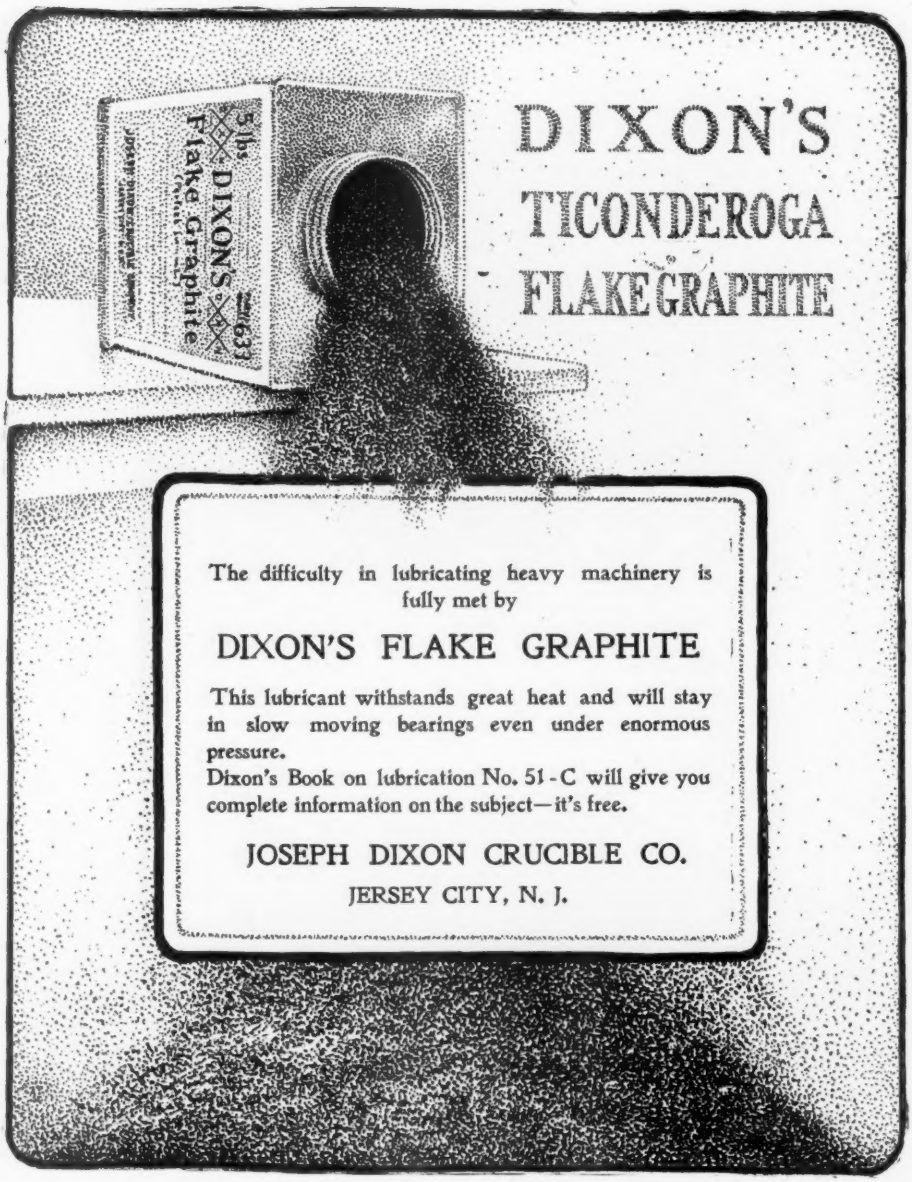
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The difficulty in lubricating heavy machinery is fully met by
DIXON'S FLAKE GRAPHITE
This lubricant withstands great heat and will stay in slow moving bearings even under enormous pressure.
Dixon's Book on lubrication No. 51-C will give you complete information on the subject—it's free.
JOSEPH DIXON CRUCIBLE CO.
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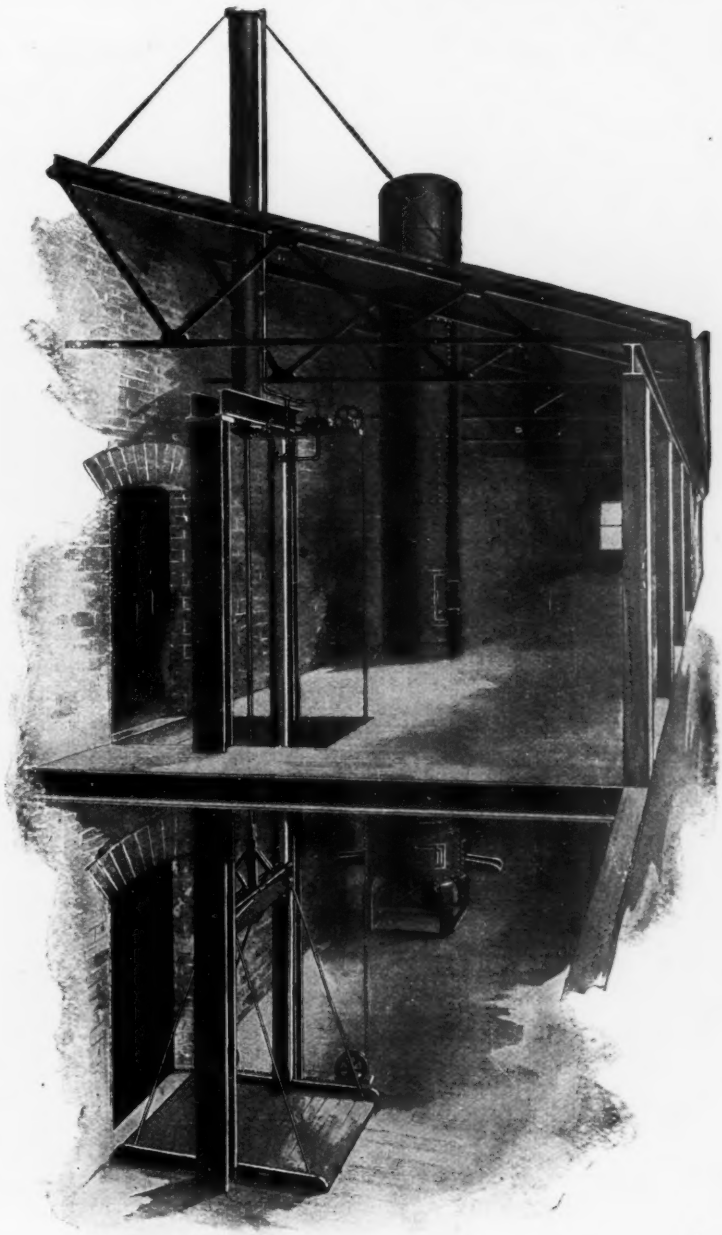
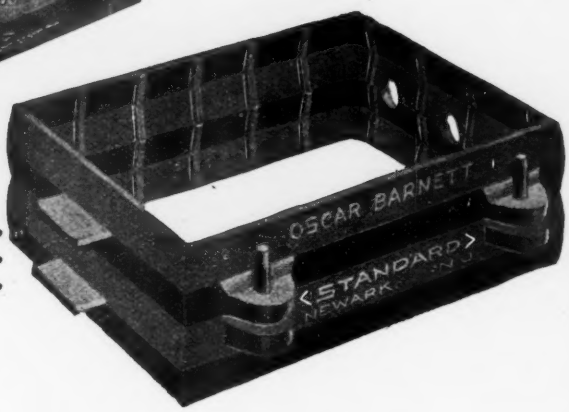


CURTIS & CO. MANUFACTURING CO.

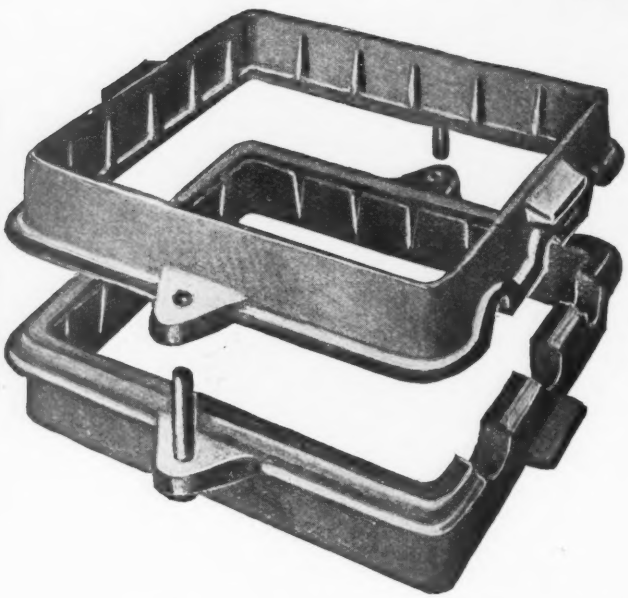
ST. LOUIS, MO.

Brass Molders' Flasks

Of Every Style and Size



Furnaces, Drying Stoves, Spill Troughs, Clamps, Boards, Tongs, Crucibles, etc., etc.



All our flasks interchange with any of same size made by us.

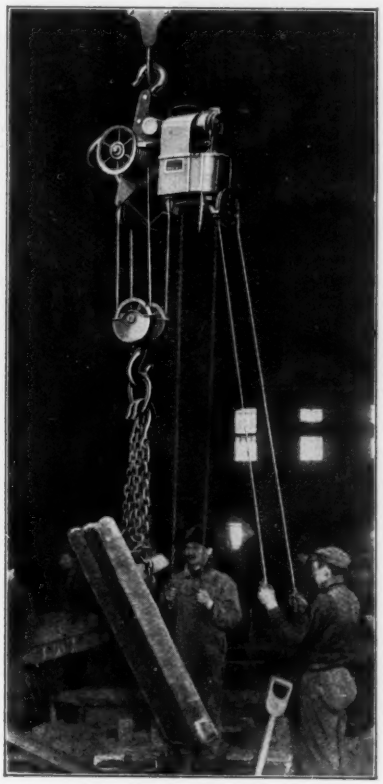
Our own foundries ensure prompt shipments.

THE OSCAR BARNETT <STANDARD> FLASK
IS MADE ONLY BY

Oscar Barnett Foundry Co.

Founded 1845 NEWARK, N. J., U.S.A.

The Cost of Foundry Lifting



If you figure current at 10c per kilowatt hour, (which is a high rate—6c per kilowatt hour would be closer the average figure), a Yale & Towne Electric Hoist with one cent's worth of current will lift a ton 33 feet.

The foundry controller is graduated to five speeds so that the hook can be eased to the fraction of an inch. This enables cores to be lifted rapidly without the least damage to the mould while the next minute a casting weighing tons may be picked up and taken to the cleaning room.

This hoist is almost as portable as a TRIPLEX CHAIN BLOCK. It is simple to install and operate, and all parts are easy of access, but carefully enclosed against dust, heat and moisture.

Our catalog pictures some foundry installations.
Write for it.

The Yale & Towne Manufacturing Company

9 Murray St. New York.

EUROPEAN WAREHOUSES—Fairbanks Co., London and Hamburg; Fenwick Freres & Co., Paris; Alfred H. Schütte, Köln a Rh.

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Modern Machine Tools

We illustrate hereunder one of our specialties for Foundry use, which has proved very satisfactory and profitable in service.

Centrifugal Sand Mixing Machine

We have furnished these machines to many users and shall be pleased to supply full particulars upon application.

TRAVELING CRANES JIB CRANES

SHOP TURNTABLES

Improved Injectors for Boiler Service

SHAFTS, HANGERS, PULLEYS, COUPLINGS, Etc.

FOR THE TRANSMISSION OF POWER.

Compare the Quality
every time you compare the price and
you will always buy

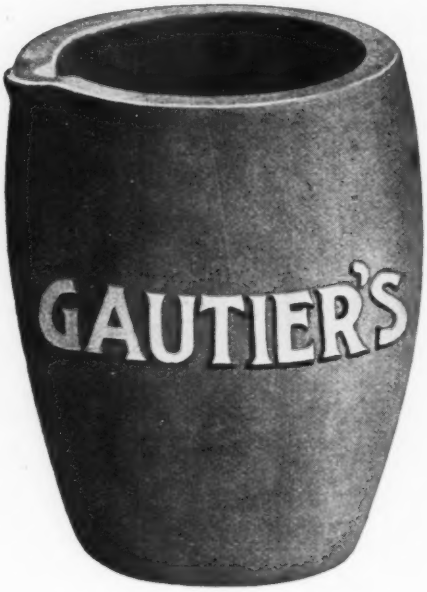
Cherry Valley Iron

the best for your foundry.
Soft, strong, uniform, fluid.

We have some for
immediate shipment.

The Cherry Valley Iron Co.
Pittsburg

No crucible is better made
or gives longer wear than



For over fifty years Brass Founders everywhere have backed us up in this statement.

J. H. Gautier & Co.

JERSEY CITY, N. J.

This trade mark stands for the acme of crucible uniformity.

No better made. The best is none too good. We spare no expense in giving the trade the best that high grade material—long experience, and careful workmanship can produce.

A trial will convince you.

Robert J. Taylor, Incorporated

1900 to 1916 Callowhill Street

PHILADELPHIA, PA.

Crucible-making has engaged our entire thought and labor for 35 years. This partly explains why McCullough-Dalzell Crucibles lead all others.

Send us an Order.

McCullough-Dalzell Crucible Co.

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Test the merits of our special crucible made for the new oil or gas crucible furnaces. Customers report excellent service. ¶ All Ross-Tacony products are made on the principle of durability.

SEND YOUR ORDERS TO TACONY, PENNA.

C. E. Mills, Specialist

REFERENCES GIVEN TO THE LARGEST FOUNDRIES IN THE COUNTRY.

MILLS DRY CORE COMPOUND

No. 1 for heavy or ordinary Core-making No. 2 for any work, but is especially adapted for Malleable Iron, Brass and Steel Foundries. It goes three times as far as Rosin, and twice as far as Flour. No blow and no absorption of moisture.

SYRACUSE X-XX-XXX CORE OILS

Perfect adaptation for all work. Best Core Oil on the market.

SYRACUSE LADELENE COMPOUND

Facing, Core Wash, Lining for Ladles, Cupolas, Locomotive and Stationery Fire Boxes, Gas Work, etc.

Half the cost making cores with our MILLS DRY CORE COMPOUND.

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Agents, Cooke County, Illinois, and State of Iowa.

HILL & GRIFFITH CO., Cincinnati, O.
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WHITEHEAD BROS. CO., Providence, R. I.
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Offices and Warehouses—122 Wellington St., Toronto, Ont.
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C. E. MILLS OIL CO.

Sole Manufacturers

SYRACUSE, N. Y.

We cordially invite the representative Brass Foundry interests of the country to a complete investigation of the advantages and merits of

The "Steele-Harvey"
CRUCIBLE BRASS MELTING FURNACE

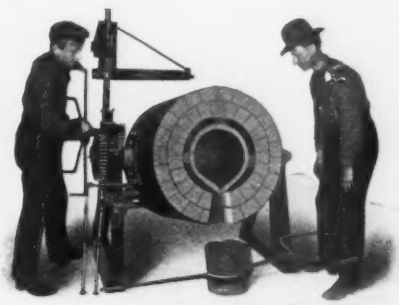
over the old coke or coal method.

Our experience and knowledge of the interests of the Foundry has been based upon an experience commencing with the old way, and developing by degrees to the present, in connection with Oil or Natural Gas and Air. We do not claim **impossible** or **extraordinary** advances, but a development of the method of melting, which is **clean, economical, labor saving,** above ground, **no ashes,** or **waste** of metal therein, **a reduction** in **cost** of fuel, using that only **which is necessary to melt** a given quantity of metal, **one** furnace doing what **3** similar coke crucibles formerly accomplished. An honest machine, which if purchased will economize for cost value within a short time, **rapidity** of **melting**—reduction in **loss**—and extension in life of crucible—maintaining a **high quality** of **metal**

Our Standard

(Patented in the United States and all foreign countries.)

IN MELTING POSITION



IN POURING POSITION

When you want it—**"It is there with the goods."** **Do not hesitate,** but request one on **trial** and **approval,** and acceptance when satisfactorily demonstrated by our representative. On account of the enormous demand we have doubled our plant capacity and are in position to ship within 24 hours of receipt of order.

Built for capacities from **120** to **1,500** lbs. **per heat.**

Don't delay—"the other fellow will get ahead."

Write for Catalog.

The Monarch Engineering & Mfg. Co.

BALTIMORE, MD., U. S. A.

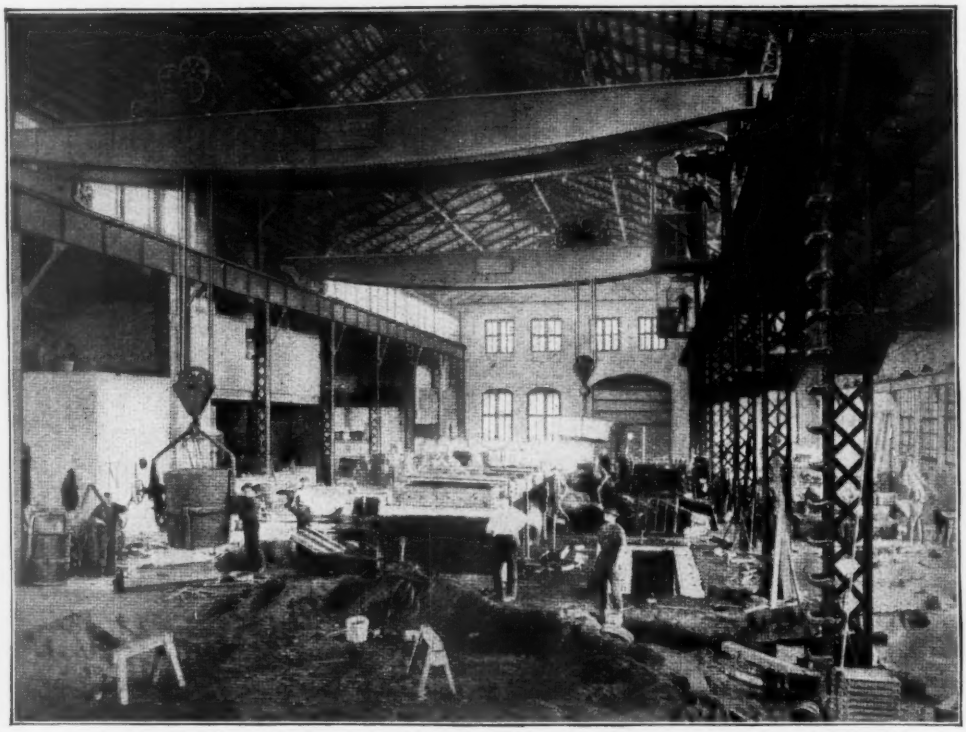
Works: Curtis Bay, Md.

EUROPEAN DEPOT—J. W. Jackman & Co., Ltd., "Caxton House," Westminster, London.

WHITING FOUNDRY EQUIPMENT CO.

General Office and Works, HARVEY, ILL., U. S. A. (Chicago Suburb)

Engineers Designers Manufacturers



Two Three-Motor Electric Traveling Cranes, Capacity twenty tons, for the Bates Machine Co., Joilet, Ill.

Cupola, 2000 in use.

Electric Travelers Cranes of All Types

Cupolas and **Machinery** for **Complete equipment** of **Foundry Plants. Contracts taken covering buildings** and **entire Installations. Inquiries Solicited.**

Have you our Catalogs? If not, send for them. Tell us about your Foundry Plans—we may be able to assist you.

THE FOUNDRY

Vol. 29, No. 3. CLEVELAND, OHIO, NOVEMBER, 1906. Whole No. 171

A Light Gray Iron Specialty Foundry.

The plant of the Ferro Machine & Foundry Co., of Cleveland, O., is unique in a number of respects. In the first place it is an evolution of the foundry business, and in the second place it is the outgrowth of the demand for very high grade castings, which has been brought into existence by the modern design of automobiles, gas and gasoline engines.

A Line of Core Benches and Rack of Cores in the Core Department.

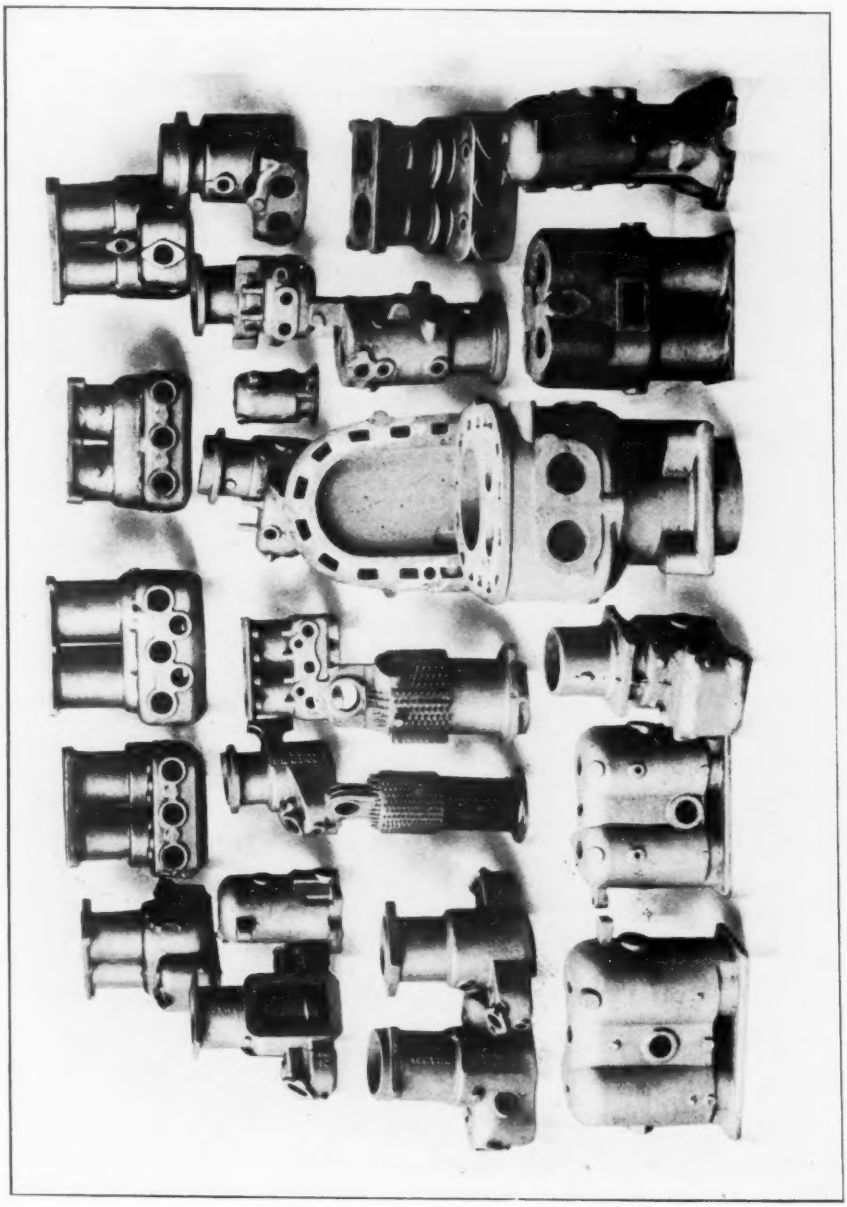
The most successful concerns in any line are usually those which make such a specialty of some particular line as to enable them to excel all others in that particular branch.

The original name of this firm was the Hoffman Hinge & Foundry Co. In the course of the evolution above referred to the hardware end was soon dropped and it became almost wholly a jobbing stove-plate foundry. When the automobile came into general use the automobile manufacturers, knowing that they required thin, sound castings, naturally turned to those concerns which had had most experience in these lines and this concern took hold of a number of automobile cylinder jobs.

Realizing the possibilities of high grade and difficult castings, the company was reorganized under its present name, and acting on Andrew Carnegie's motto, the management started out to "get brains wherever it could find them." This resulted in its secur-

ing the services of some of the best and brightest men in the foundry and automobile trades. One step led to another, until today this foundry, although comparatively small, supports a chemical laboratory and metallurgical and foundry staff larger than that found in many concerns melting ten times the tonnage and employing a very much larger number of men.

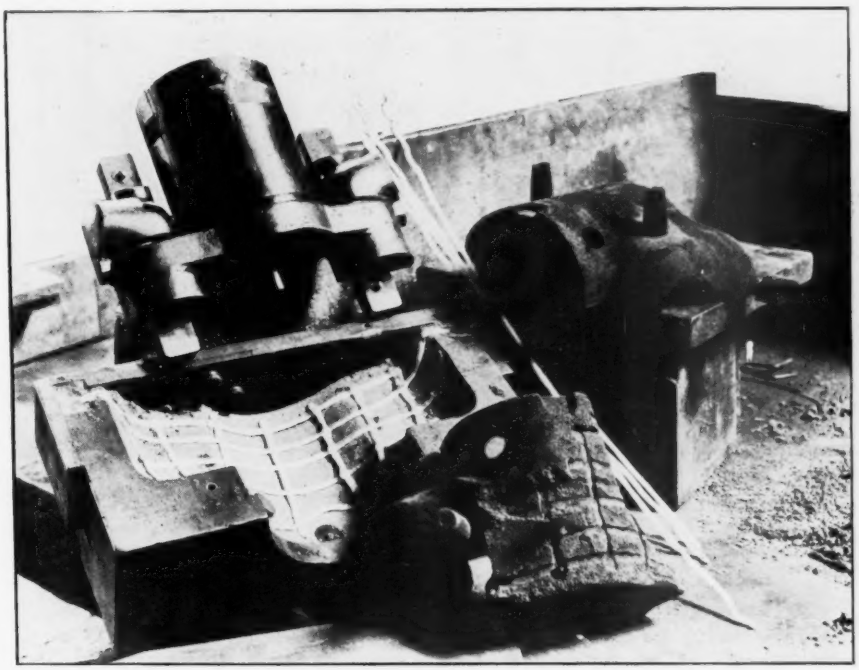
In order to insure a line of steady work, and also on account of the fact that a machine shop is desirable for certain purposes, it was decided to go into the manufacture of gasoline engines especially designed for marine work. To supply this demand a machine shop has been equipped with the very latest tools, both standard and special. This machine shop is also



A Number of Cylinders Which are Being Made at the Present Time.

very handy, as it enables the company to take contracts for difficult and intricate castings and then to machine them before they leave the works.

The range of the work now manufactured may be judged somewhat from the fact that castings are furnished to concerns all the way from Topeka, Kan., to Providence, R. I., and that at least twenty-five different patterns of automobile cylinders are constantly in the sand. The accompanying illustration shows a collection of various types of cylinders turned out from this foundry.



VENTING OF JACKET CORES.

It is a fact worthy of note that no concern would today think of making on the one hand such standard equipment as cap screws, wood screws, etc., while on the other hand no progressive concern would think for a moment of attempting to manufacture its own machine tools of standard types. In like manner the majority of the foundries are coming to recognize the fact that certain classes of castings are specialties and should be handled by some one making a specialty of that particular class. It is this modern tendency that has brought the plant of the Ferro Machine & Foundry Co. to its present state of excellence.

The production of a perfect casting is the result of a large number of factors operating in harmony. For instance, the intricate cored work required in an automobile cylinder necessitates, first, a careful selection of core sands and binders; second, carefully constructed core boxes, core dryers, core ovens, etc.; third, accurately fitted patterns and foundry rigging, including flasks and other special appliances; fourth, very careful manipulation in melting and in the ascertaining of the proper mixtures of iron to use; fifth, the type of mold, that is, dry sand or green sand.

To meet these different requirements it has been necessary to expend a very large amount of thought and to carry on many exceedingly expensive experiments. In this connec-

tion one point of interest is that the company employs an engineer who is in charge of the rigging, his whole duty being to study the work in the foundry and suggest new and improved methods of carrying it on. After any given problem has been studied until the "engineer of methods" believes he has arrived at a correct solution, a meeting of the foundry superintendent, metallurgist, and other members of the general staff is called. The proposed rigging is then thoroughly discussed and this discussion frequently results in decided improvements. In other words, much of the success of this plan is due to good team work.

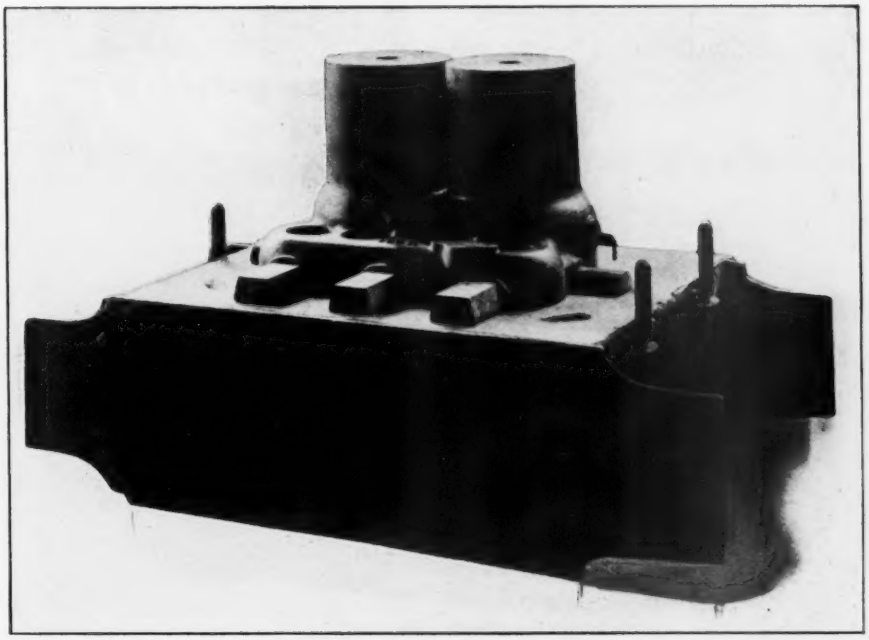
In many of the large foundries where only a few small castings are required, these small castings may be poured on a day when much large and important work is on the floor, and hence they do not receive proper attention. The result is that three or four attempts have to be made to secure one good casting. In such cases it would be far cheaper to secure the good casting in the first place from such a foundry as the one under consideration, even though the price charged therefor might seem very high at first. Many large manufacturers are now securing difficult castings, which have to be machined all over and show a perfectly clean surface throughout, from this company.

Where any casting is to be turned out in quantity the company prefers to make the patterns and core boxes and employs a force of twenty-five patternmakers covering all classes of wood and metal pattern work.

RAMMING DRY SAND MOLDS.

It is exceedingly difficult to give any comparative statements of the output of such a plant as this, on account of the fact that the tonnage is comparatively small, due to the intricate nature of the work. There are three hundred men employed in the foundry proper. Of this number, seventy-five are coremakers. The original melting equipment consisted of one 60-inch cupola. To this was added a five-ton air furnace. In order to keep pace with the rapid increase in the work, however, it has been found necessary to install a second air furnace of fifteen tons capacity.

Many of the more intricate cylinders and difficult castings have to be made in dry sand molds. To take



DRAG RAMMED UP AND PATTERN IN PLACE READY FOR THE CHEEK.

care of this work, one mold oven is now in use and a second one under consideration. The core department contains three banks or sets of core ovens which are divided into units with doors on the sides, giving ready access to the various shelves for the placing of core plates into ovens, or for removal of the baked cores. All of the core ovens are being equipped with pyrometers.

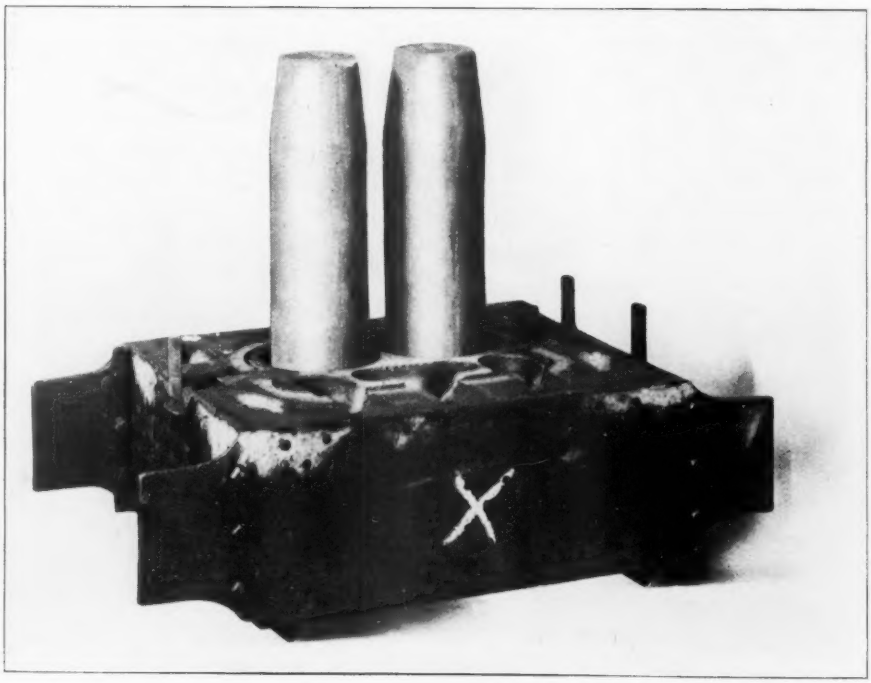
It goes without saying that this plant must be equipped with a very good cleaning department, but the equipment in this department is of standard type, consisting mostly of Sly tumbling barrels of the exhaust pattern.

One point of interest in connection with the plant is that all power is furnished by gas engines driven by natural gas. These operate electric generators which furnish power for the various operations of the plant.

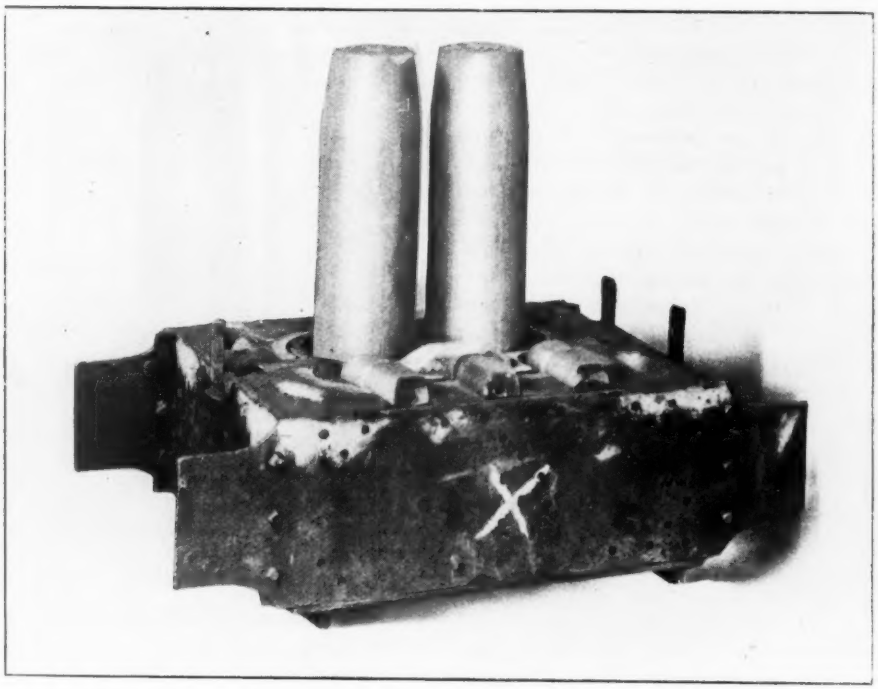
All of the automobile cylinders are tested under 150 pounds hydraulic pressure. All castings are also checked or measured up carefully before being shipped. This latter precaution has been found necessary on account

ASSEMBLED CORES.

of the fact that several of the con-



DRAG JACKET AND BARREL CORES SET.



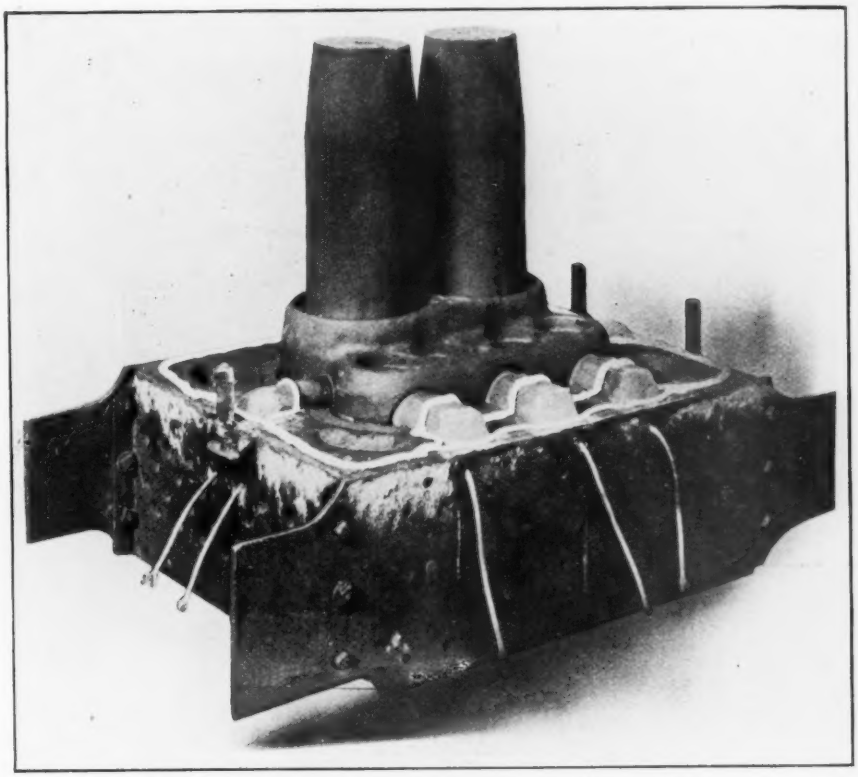
DRAG JACKET, BARREL AND PORT CORES IN PLACE.

tracts being fulfilled require the setting of the cores within a limit of 1-32 of an inch.

Among the specialties which this company is willing to guarantee to supply are light castings not over ⅛ of an inch in thickness which show no chill, but are poured from iron that has a strength of 30,000 pounds per square inch.

Some idea of the range of cylinders made can be had from the accompanying illustration showing twenty-five types which were being turned out at the time the writer visited the plant. One of the other illustrations shows one bay, or section, in the core shop. The core makers work upon benches in front of windows. Back of these benches are situated tables, or benches, upon which the cores are all tested and checked up after they are baked. After the cores have been tested they are passed to storage, or stocked on the shelves as shown at the left of the view.

One interesting feature of the equipment is the press shown on the front end of the table in the center of the picture. This press is used for turning out wax tapers, for venting cores, or for turning out what are known in the foundry as noodles. These are pressed from dough made from flour and water, and are used as illustrated in the assembling of the cylinder molds, as shown in the accompanying illustrations.

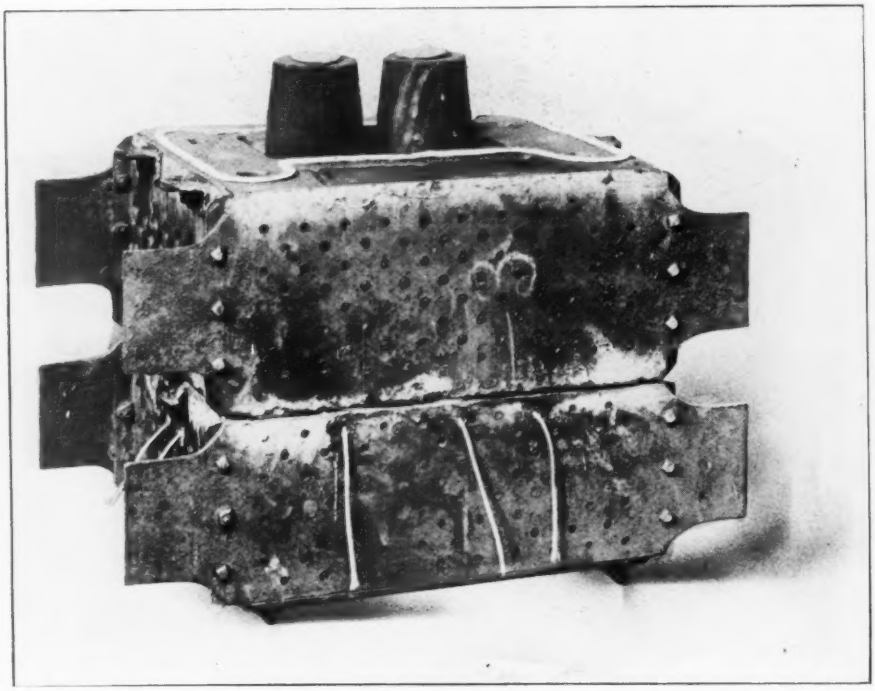


ALL CORES IN PLACE READY FOR CHEEK.

The use of the wax tapers for venting difficult jacket core work is illustrated in another view. The core box shown in the lower left hand portion of the view has had the first layer of sand placed in position and the wax tapers adjusted for venting. Some of

the tapers are shown at the right of the core box. They are made from paraffin wax and are warmed before use to render them pliable. After the tapers have been placed in the box the balance of the sand is rammed in and the upper portion of the box shown at the top of the view placed in position. One of the completed cores is shown at the right, while in the foreground leaning against the core box can be seen a portion of one of the cores which has been broken open to expose the vents. During the drying process the paraffin is all absorbed by the core sand, thus leaving the vents free or open. The vent is all taken off through the core prints. Of course it is necessary to use a few wires to stiffen such a core, and these are located so that they can be drawn out through one of the cored holes in the finished casting.

The majority of the more intricate cylinders are cast in dry sand molds. One of the accompanying illustrations shows a gang of four men engaged in putting up such molds, while another of the illustrations shows one of the molds under construction. The drag has been rammed up and the cheek portion of the pattern placed in position ready for ramming the cheek. Especial attention is called to the flask construction. These flasks are made of cast iron plates accurately fitted and bolted together. The plates are perforated to facilitate the escape of the steam during the drying of the molds.



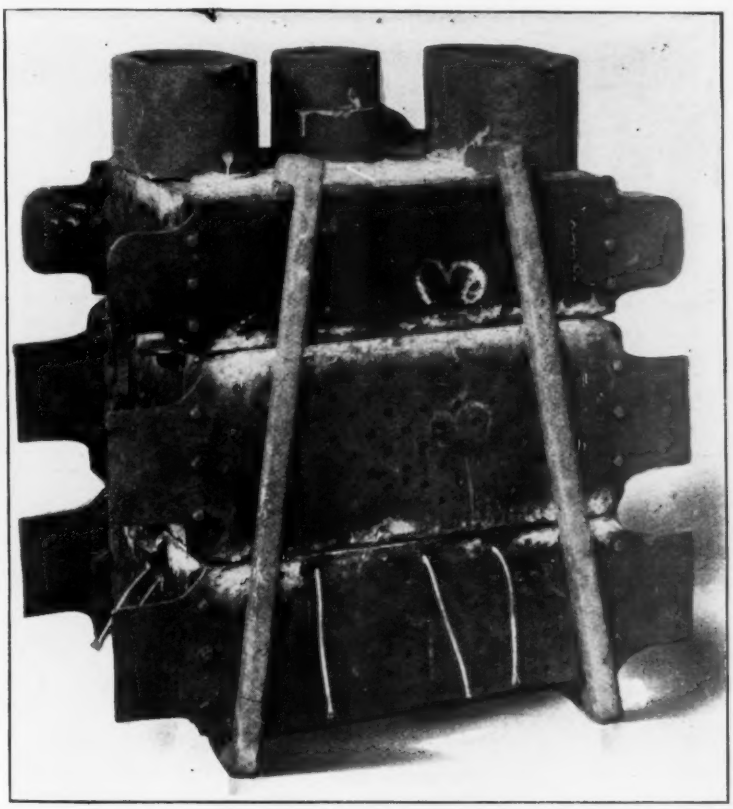
CHEEK IN PLACE READY FOR COPE.

The detailed operations of assembling one of the molds with its cores are shown in some of the other views. First, the cores are shown assembled as they would appear in the mold. Next, the drag portion of the mold with the barrel and drag jacket cores in place is shown. After this the port cores are set as shown in the next illustration.

Next, the upper or cheek portion of the jacket core is introduced and paste "noodles" placed about the joint as

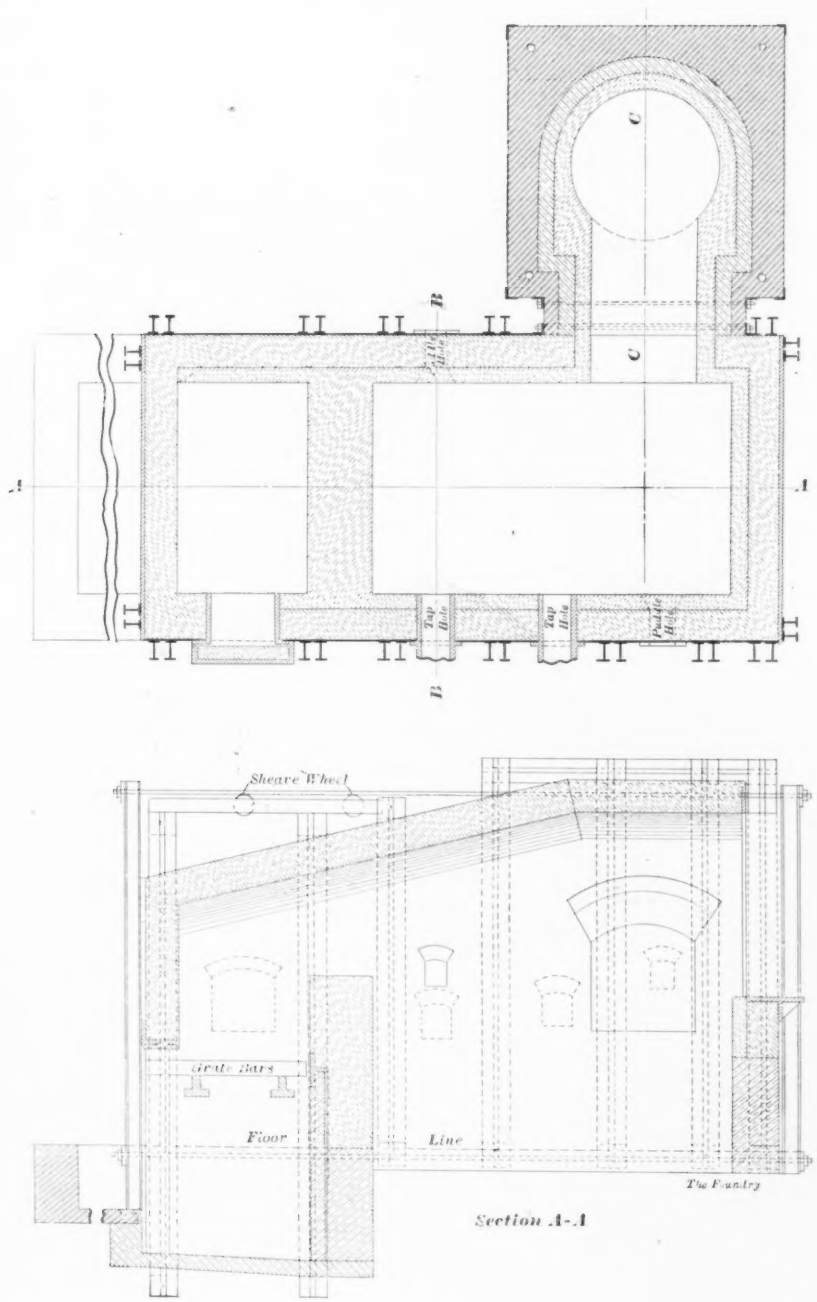
shown to prevent any run-out. The cheek is then slipped over as shown in the next view. Attention is called to the rope ends hanging from the drag portion of the flask. These connect with the vent passages at the end of the cores and are withdrawn just previous to pouring, so as to insure a clear passage for the escape of the gases from the jacket cores. The last view in this series shows the mold with a cope in place, clamps set, and runner boxes attached. One thing of interest in connection with the placing of the runner boxes is that each of the down gates is covered with a small square of tin, having a few small holes punched in it, before the runner box is applied. This tin gives a momentary resistance to the metal as it enters and enables the molder to maintain a head in the runner box. The tin melts almost instantly and allows a flood of iron to rush down and into the mold. This quick pouring is found absolutely necessary if accurate castings are to be produced.

One of the other views shows one line of benches on the cylinder floor with the No. 2 air furnace in the background, and another shows the quadruple and twin cylinder floor, with a number of men engaged in placing the runner boxes in position.

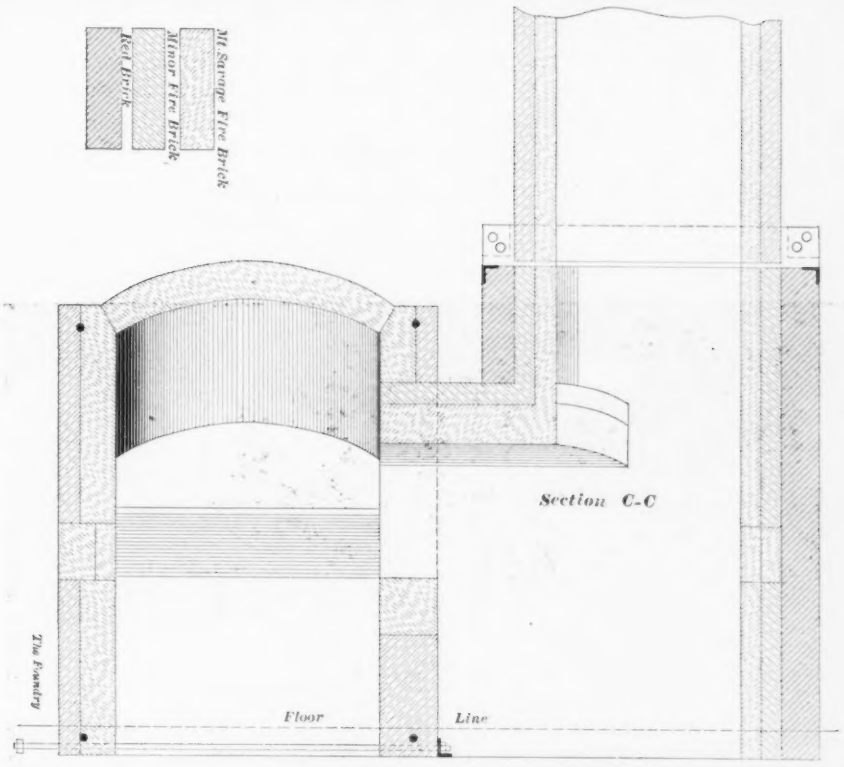


MOLD READY TO BE POURED.

The general construction of the No. 1 air furnace is also shown in the accompanying line cut. This furnace was designed by L. G. Blunt, the metallurgist of the plant, whose series of articles on air furnace practice was published in THE FOUNDRY some time ago and will be remembered by all of the readers. The larger, or 15-ton furnace, is constructed on the



SECTIONAL PLAN AND LONGITUDINAL SECTION OF AIR FURNACE.



CROSS SECTION OF AIR FURNACE AND STACK

QUADRUPLE AND TWIN CYLINDER FLOOR.

same general lines, though of course the dimensions are greater.

Some advantages of the use of the air furnace for pouring this class of castings are that the entire bath of metal can be brought to the desired composition and tested previous to tapping so that the test bars poured from the heat can be depended upon to represent accurately the composition of the castings poured from the furnace. When pouring from cupola iron, even with the very best of melting, irregularities will often occur which cause the iron to vary greatly between successive tappings.

Another advantage is that in melting in the air furnace, the composition of the iron in regard to certain impurities such as sulphur can be controlled very much more closely.

There is one point, however, which is worthy of mention, and that is, that no one factor in all of the series mentioned can be depended upon to produce perfect castings unless all of the separate factors are in harmony. It is also interesting to note that while the air furnace in the hands of a skillful melter can be depended upon to produce iron of uniformly high grade composition, if the same furnace is placed in less skillful hands, the iron is liable to vary between wider limits than would be the case with cupola metal. In the cupola, if the proper amount of coke is charged and the blast pressure maintained at the ordinary point, the process is, to a large extent, fool-proof; but with the air furnace this is not true, and comparatively small variations in the treatment of the bath may result disastrously to the product. As stated above, the test bars are the tell-tale which always remain to show how the process is working.

ONE LINE OF BENCHES ON THE CYLINDER FLOOR WITH NO. 1 AIR FURNACE IN THE REAR.

DIRECT METAL.

There have been a good many inquiries directed to THE FOUNDRY from time to time concerning the use of direct metal for castings, that is, the pouring of castings with iron direct from the blast furnace. In connection with some of these inquiries the editor sent out letters to a number of parties who had had more or less experience in the matter, and some of the replies are exceedingly interesting.

Thos. D. West, who uses direct metal very extensively in the casting of ingot molds, gives some very interesting information upon the subject, some of which is as follows:

No one can make a general line of work from direct metal. The reason that direct metal cannot be used for general work is on account of its being so dirty. We can use it for ingot molds in a commercial way on account of the fact that we cast our molds with an open top and scrape off the dirt. Mr. West states that it is not direct metal which enables them to compete so successfully in the ingot mold business, but that it is the location and design of their shop and the careful management of all points of work.

Another point which is to be considered in attempting to use direct metal for general work lies in the fact that founders who can use scrap in a mixture with pig iron will obtain metal in the ladle which will cost less in dollars and cents than direct metal, for with direct metal the entire output is made of pig iron.

The above remarks certainly are exceedingly damaging to the use of direct metal, but at the same time we know that in Europe direct metal is used quite extensively, but that there it is practically always used by first passing the metal through a mixer. There was a time when practically all castings were made direct from the blast furnace, but the blast furnaces in that day were driven very slowly and the metal was much lower in carbon than at present, and especially low in silicon.

One man who has had quite extensive experience in making direct metal castings for repair work for blast furnace plants states that castings which can be easily machined can be made from blast furnace metal so low in carbon and silicon, and particularly in silicon, that if it were passed through the cupola it would produce only white castings. We know that metal of this character can be made with a lower coke ratio in the blast furnace and, hence, costs less per ton, and it may be that the final secret of the use of direct metal will be found in this line.

If direct metal comes into general use in this country it may also be possible that the electric furnace will be used as in the experiments at the Soo which were conducted by the Canadian government, and which seem to give such great promise of future success.

The Western Foundry Supply Co., of East St. Louis, Ill., is sending out a very attractive calendar, the pad of which begins with September, 1906, and ends with August, 1907, thus corresponding more nearly with the business year as reckoned from vacation time to vacation time. The calendar consists of a square panel showing the summer girl enjoying a dip in the ocean. The picture is mounted upon a red card, 12 x 20 inches, with a calendar pad at the bottom.

The American Blower Co., of Detroit, Mich., is sending out several new catalogs, among which there are two of interest to foundrymen. Both of these are 7 x 8¼ inches. One describes the American Blower Co.'s heating, ventilating and drying systems, illustrating the "ABC" blowers for cupolas, forges and other purposes, while the other describes the "ABC" steel plate fans for heating, ventilating, and drying plants, etc. Both of these catalogs are well illustrated and contain a large amount of very valuable information, but it is inconceivable to us that a company of the standing of the American Blower Co. should continue to use an odd size catalog, which is almost always consigned to the waste basket on account of the difficulty of filing it, when by adopting the standard size they would have something that would fit any regular catalog file.

PRESIDENTIAL ADDRESS.*

Gentlemen:—In addressing you for the first time as president, let me first of all thank you for the honor which you have conferred upon me. It is one which I highly appreciate. I regard associations and institutions of this type as powerful factors for educational work; and the British Foundrymen's Association, I think, will inevitably exert great influence on the education of the foundrymen of this country.

The progress of the association since we first met at Manchester two years ago, and at Glasgow last year, has been extremely satisfactory and has involved much hard work on the part of Mr. Buchanan and Mr. Finch. No association of this kind can be formed without a good deal of arduous pioneer work and the overcoming of difficulties incidental to a newly formed association; however, "Nothing succeeds like success," and the association is becoming firmly established as a progressive and substantial institution. The number of members at the time of the Manchester meeting was 83, at the time of the Glasgow meeting 121. Today our members number 180, and I have no doubt that these figures will soon be greatly increased upon.

The objects of our association have already been amply explained to you, and I think we are fully understood, but I do not think we can too often reiterate the great educational value of our papers and the ensuing discussions, together with the visits to various works.

It is the desire of your council that, so far as we possibly can, we should induce iron founders themselves to become members and take part in our work and discussions. Nothing but good to founders can accrue from an association formed from such a body of members engaged in all the branches of founding, taking their part in the discussions of scientific and practical founding, and the application of scientific research to every part of it. It is also the desire of the council that every encouragement should be given to the formation of district branches of the association, several of which are now in successful operation. It is manifest that these district associations could meet more frequently than the parent institution, and where there are sufficient members for a district association, if at all possible, it should be formed. This will not only keep the members of the district in touch with each other, but will also materially strengthen the association in general.

It has often been pointed out that scientific education has not usually formed part of the foundryman's equipment. I feel convinced that this state of things, however true at one time, is now undergoing a process of considerable change and improvement; and there is no doubt that so far as managers and foremen are concerned they are all of an infinitely superior type to what they were only a short time ago.

It is frequently asserted also that the educational facilities in this country are such that the iron founders and their managers and foremen have not the means of obtaining such scientific, or so called technical education, as in some of those countries with which we compete. I am not one of those people who necessarily find fault with our own system because it happens to be British, any more than I would find fault with the Britisher for the same reason, and I do not think that in these days we suffer much, if any at all, in comparison with other nations, either in regard to personnel or education. It appears to me that the higher educational facilities in this country are such as to provide a training as superior as that which can be obtained in any other country. The multiplication of our engineering colleges and universities has been very great, and their equipment has been ample and even lavish; while many, in their departments of metallurgy and engineering have provided them-

*Address given by Mr. H. Pilkington, President of the British Foundrymen's Association, at the Middlesborough meeting.

selves with miniature plants for purposes of demonstration and research. So far as these miniature plants at metallurgical and engineering colleges are devoted to such demonstration and research, I do not think they are likely to form the subject of any criticism; but they must naturally be of very little value when it comes to teaching methods of practical work such as we are accustomed to in the works; indeed there is a distinct danger, as far as I have observed, that young men coming from these institutions have to spend a considerable time in unlearning a great many things they have acquired which they had hitherto supposed to be of the nature of practical operations.

I am aware that I am treading on delicate ground, but to me it seems that the alliance between the so-called technical education colleges and those colleges which are devoted to what is after all mostly literary education, in the formation of new universities, is one which does not seem to be as yet altogether to the advantage of high class technical training, and seems rather to turn out men who belong to the academy more than to the workshop. This academical spirit most frequently runs through the whole of the teaching staff from the professor downwards, and it is this kind of spirit which makes it questonable whether the professor or teacher should be entrusted with the handling of even the toy plants they possess; further, I do not think any chair of metallurgy or engineering should be occupied by any man who has had only a purely academical training.

Turning to the molder himself, from what I have seen in several countries, the British molder whatever his faults may be has nothing to fear as a practical man in comparison with those of any nation, and I think we shall have to admit that, as a molder, technical education has not usually formed part of his equipment.

It is an unfortunate fact to this country, that, as a body they do not display much eagerness for educational improvement and apprentices as a rule, devote themselves very much more to sports than to their own intellectual improvement. This is no doubt partly brought about by the character and methods of instruction in the primary schools; and it is a system which will take a considerable time to alter.

This association does not concern itself with disputes between the employer and the employed, but there is one species of relationship, which I think, may be fittingly referred to as an educational matter, which many of us would like to see further developed, and that is, that not only should the employers and the managers take the greatest possible interest in the education of those they employ, but they should also take a deep personal interest in their recreations and amusements. Every effort should be made, particularly so at large works, to provide such facilities as gymnasiums, ground for athletics, reading rooms, lecture rooms, libraries, clubs and baths. Every effort of this kind, fostered by the proprietors or the management, leading to the improvement of the workmen must, I am convinced, eventually produce a type of men capable of appreciating the advantages of education and eager to take the opportunities of acquiring it. I would go further, and see that all the apprentices attended certain courses in science classes bearing upon their particular class of work, and, if possible, of arrangement, these subjects should be taught by members of the works staff.

The educational system of this country, both primary and secondary, and that of the universities, has been undergoing a period of extensive and far-reaching changes. The primary part of it, in particular, has been slowly changing, but has suffered intensely in its progress, and has been much retarded by the never-ending interference of religious factions, while the cause of education itself has taken a secondary place. There is also no doubt, as was alluded to in a previous presidential address, that the nature of the elementary education imparted is by no means yet satisfactory; still, as one of those interested in school management and in education generally, I can see that considerable improvements have taken place, and

doubtless will do more rapidly, as the practical organization improves, and the promotion of co-ordination in primary, secondary and university education progresses. In the primary schools the children should be kept at school until they are older than at present, and the absurd and ridiculous half-time system should be abolished. In the higher standards or higher grade schools, elementary science should be generally taught and with greater thoroughness than the education department have hitherto taught it. While the science and art section of the educational department has been of great use to many of our workmen, and has enabled numbers of them to become foremen and managers, its methods of teaching cannot, up to the present, be regarded as satisfactory, or at all thorough, and it appears that the hope in the future lies with the fusion of this department with evening continuation schools and the higher grade and secondary schools staffed with a superior class of teachers.

At a meeting in such a place as Middlesbrough with its historical name in all that concerns iron and engineering, it cannot but be a subject of interest to refer, in some measure in this address, to the manufacture of pig iron and the blast furnaces in which it is made. The whole basis of the beginning of the iron trade at Middlesbrough, and the very great increase in the production of pig iron subsequently, was the discovery of ironstone in the Cleveland hills; and although Middlesbrough now imports very large quantities of foreign ores, its own ore was really the basis, and is still, of the iron and engineering trade it possesses. There have been many authorities who have expressed alarm at the impending scarcity of iron ore in the future, and who have pointed to the fact that we import some eight million tons of ore per year while we only raise about fourteen million tons. It may be pointed out, however, that almost the whole of the imported ores are used for the purposes of acid steel making, so that practically all the iron which is used in foundries, is made from British ores, and the iron founder, whatever happens to the steel maker, need have no fear with regard to the future of this class of material for a long time to come.

The lias and oolitic ore deposits of this country begin in the Cleveland hills, and stretch all the way, more or less irregularly, through Lincolnshire, Rutlandshire, Leicestershire, Northamptonshire and Oxfordshire to Kent and Sussex; and this latter county was doubtless the earliest home of iron production. Many of the authorities appear to have held the extent of these ores to be of little account, which, in my opinion, from a long experience in working them, is an entirely mistaken view to take. In the Midland districts, in many instances, the surface outcrops only have been worked, and then only the richest takes, while in the deep, vast quantities of ore remain untouched more or less similar in origin to those in Middlesbrough, but much richer. There are also large quantities of ores which apparently are not seriously regarded at present in the oolitic districts, and these are surface ores with an iron content varying from 18 per cent to 23 per cent of iron. If these ores could be cheaply concentrated, as they undoubtedly will be, then indeed the supply of foundry pig iron is most amply guaranteed for long periods to come. These ores have always been, since they were worked, chiefly used for making foundry pig iron, for which purpose they are eminently suitable, and they form absolutely the cheapest and most plentiful sources of supply in this country. The Cleveland district alone raises nearly six million tons of these lias ores per annum.

Nothing is more striking to contemplate than the remarkable increase in the world's production of pig iron. This production in 1905 was 54,000,000 tons, it having exactly doubled itself in fifteen years. Of this, the United States of America made 22,992,380 tons, Germany, 10,987,623 tons; Great Britain, 9,592,737 tons. Great Britain has taken practically no part in this huge increase in production, which has been mainly confined to America, Germany, France and Belgium.

In 1867, the world consumed approximately 20 pounds of iron per head of

population. In 1905, this amounted approximately to 85 pounds per head of population. The United States of America now consumes about 600 pounds per head of population per annum, while the United Kingdom consumes about 500 pounds per head. If we consider 85 pounds as the world's average consumption, and remember that there are vast populations with a consumption of under one pound per head, it will be seen that there is every prospect of still more startling increases of production of pig iron before the degree of average civilization reaches that of the enormous consumption of 600 pounds per head.

Cleveland ore appears to have been brought into use in a practical way in 1850, and the furnaces of that time did not exceed from 45 to 50 feet in height, and did not greatly exceed a make of 100 tons of pig iron per week. We shall have an opportunity during this week of seeing furnaces on Cleveland ore making 1,400 to 1,500 tons per week of iron, in furnaces 90 to 100 feet high. These figures, of course, pale into insignificance when contrasted with the huge makes of hematite at Pittsburg, where over 600 tons per day is an ordinary output, but they sufficiently indicate the great progress made in blast furnace practice in Cleveland.

Previous to 1850 it would require four or five tons of coal, used as coke, to make a ton of pig iron. Neilson's hot blast was introduced about 1835 in Scotland, and the Cowper stove about 1862 in Cleveland, and by means of these and other improvements, amongst which should be mentioned the by-product coke ovens now so general, the consumption of coal per ton of pig iron is as low, or lower than 30 cwts. when using Cleveland ore. This 30 cwts. of coal, used in the form of coke, is the only fuel used for the production of pig iron, as the hot blast is produced, and the steam for all power operations is raised, by means of the so-called "waste gases" which, prior to 1860, had mostly escaped to waste at the tunnel head, although closed tops were introduced at Ebbw Vale in 1848.

A further development in furnace practice has taken place recently, and that is, the generation of power by means of the blast furnace gas engine. By this means very large quantities of power can be produced for use in operations quite external to the blast furnace itself. With the assistance of Mr. Thwaite I put down gas engines at Sheepbridge Works so far back as 1899, by means of which power was generated from blast furnace gas to operate a large new pipe foundry, and to-day the power required for the production of some 600 tons of pipes and castings per week and the machine shops connected with them is wholly produced by means of blast furnace gas; the furnaces furnishing not only the power but the iron as well. This was probably the first successful installation for power production from blast furnace gas in this country. The small engines installed by Mr. Riley at Glasgow was indeed previous to this, but was used for electric lighting. There were at least two other engines which, however, did not continue their operations. There is an enormous field for development in this direction, and the association will see a very notable installation at one of the works they will visit during their stay at Middlesbrough.

By the use of blast furnace gas in internal combustion engines, there is a very great economy of gas used, the consumption being only about 110 cubic feet per I. H. P. developed, as compared with four or five times that quantity when used by means of steam boilers and steam engines.

As the average blast furnace produces about 170,000 cubic feet of gas per ton of pig iron produced, it will readily be seen what enormous sources of power are available. If the power required for the blast furnace operations were produced by means of internal combustion engines, probably half the gas produced could then be utilized for the production of power for other purposes. This suggests that in the future blast furnaces will become as it were, gas producers to plants required for turning pig iron into finished products, and that all finishing

plants of whatever character in future, will be incomplete without blast furnaces to supply the requisite power to drive them.

This evolution would appear to be quite a natural one when applied to the large iron and steel works of this country, some of which it will be our privilege to visit in Middlesbrough, but to those who are also connected with foundry work in its largest developments, it appears that the application of this source of power will be by no means confined to steel works, but will also be applied generally as it has been, to foundry operations.

An ideal plant for large and heavy foundry operations might be described as having blast furnaces as its essential central factor, making pig iron, and producing gas in sufficient quantities to supply all the power required, the power being generated by means of gas engines working on the blast furnace gases, and either driving the machines direct, or generating electrical power and transmitting it to the various shops. All the foundry stoves could be heated with blast furnace gas. The pig iron could be run into ladles, passed through a mixer, kept hot by blast furnace gas, and the metal for the castings taken from the mixer direct, without the intervention of a cupola in any shape or form; thus, no fuel would be used about the plant except that put into the blast furnaces themselves for producing the pig iron. No electrical smelting plant of any kind could ever possibly compete with a plant of this nature. Pig iron used direct in this manner for making castings is an indefinitely superior metal in every way to that melted in cupolas; it is much softer and has a lower content of sulphur and manganese than the remelted iron from the same stock.

The heavy increase in the production of iron at blast furnaces in recent years, has naturally reduced the cost of labor required to produce it, and this has been still further reduced by the almost enforced necessity for the mechanical handling of such large quantities of materials in a given time. In the case of pig iron, this has led to its being handled molten by means of ladles, either in connection with a mixer or a casting machine, or by handling it cold by means of electric cranes and breaking machines.

The most striking mechanical development, however, has been in the handling of the materials charged into the furnace top. The ores and fuels are dropped from hopper bottomed wagons by gravity into bunkers, from these they are also drawn by gravity into electrically propelled trolleys upon which they are weighed; they are then delivered by these trolleys to the furnace skips into which they are dropped again by gravity. These skips are on an incline and are drawn electrically to the top of the furnace, where the materials are automatically dumped into the hopper placed over the top of the bell. There are no men on the top of the furnace, all the operations of hoisting and bell lowering being governed by means of levers operated by the trolley man at the foot of the incline.

With regard to the pig iron itself, perhaps the most notable development of recent years has been the application of the new science of metallography to the examination of the internal structure of the iron and the revelation it has made with regard to its different crystallizations according to the way it has been cooled down from the molten to the cooler state. May I point out with regard to this development that the examination of pig iron, by means of the microscope in order that we may examine its crystallization, is only a development of the judging and grading of it by fracture, the one is done by means of the microscope and the other by means of the naked eye. As there is a paper on the grading of foundry iron I will make no further comment except to say that it still appears that not only must the analysis be taken into account, but also the crystallization.

Turning briefly for a moment to the foundry itself, I should like to see some papers given before the association upon the subject of "Cupola Practice" particularly with regard to the economy of coke in melting. This subject is one

with which I have often had to deal, and in a lesser way is almost as interesting as that of the blast furnace. As a matter of experience I may relate that certain cupolas in Staffordshire which were blown by the blowing engines attached to the blast furnaces, that is to say, the blast pressure was about 3½ lbs. at the engines, in the course of time were blown by a Roots blower at about 1½ lbs. pressure. The result was an immediate large reduction in the consumption of fuel, the only other alteration was that the tuyere area had to be increased to get in the requisite volume of blast at the lower pressure. Again, in applying electricity to blowers in recent years it has been found more convenient to use electrically propelled fans, directly coupled, instead of Roots blowers, the blast pressure from these fans is less than that of the Roots blowers, and the tuyere area has to be somewhat increased to compensate for this. The result has again been a saving in coke. All this experience goes to show that the quantity of blast blown into the cupola should be regulated by the tuyere area and the revolutions of the blower, and the pressure of the blast should be kept low. Every increase of working height in a cupola so far as my experience has gone has resulted in an economy of coke, and it is an interesting point as to how high the charging level may be raised relative to the capacity of the cupola, and the question of blast pressure. The ordinary foundry cupola suffers a serious disability, inasmuch as its operations are intermittent and the coke for the bed is a necessary loss which has to be faced daily. In steel works, where cupolas are in continuous operation, the coke consumption is astonishingly low, and steel works practice in cupola work has many interesting features which founders might with great profit study.

There are many other subjects of interest to foundrymen which might well have been touched upon in this address, but there are limits within which it is well to confine it, having regard to the interest in its iron developments.

I sincerely hope that in all matters of practical interest in the foundry, the members of the Association will not hesitate to make them the subject of papers and discussions, as well as those more scientific subjects which we have had so generously placed before us. There is plenty of room for investigation, as the most casual study of the scrap or waster heap will any day show at the smartest foundry.

The object which this association has most particularly in view is to throw plenty of light about all the practical operations of foundry practice. Our duty is to sweep away all the supposed mysteries of the foundry, and effectually to remove the empirical from all foundry operations.

I entertain no doubt whatever that the association will most worthily fulfil its destiny.

The Whiting Foundry Equipment Co., of Harvey, Ill., is sending out two catalogs, known as Nos. 47 and 48. The first describes and illustrates various classes of ladles manufactured by this company. Catalog No. 48 describes the "Solenoid" brakes, as used for controlling electrically-driven machinery.

Newhall Chain Forge & Iron Co., with offices in the Franklin building, New York city, is sending out a catalog describing the hand-forged crane, block and hoisting chain manufactured by this company. One interesting feature in connection with the catalog is a series of diagrams showing the manner in which the stock for various classes of chains is forged so as to develop the greatest possible strength. The catalog also contains illustrations and descriptions of various auxiliary chain appliances, such as hooks, shackles, etc.

The Avondale Stove & Foundry Co., Birmingham, Ala., has published a catalog 8 x 10½ inches illustrating and describing the large line of stoves and ranges of all classes manufactured by this company. There is also quite a line of hollow ware illustrated. The catalog contains 112 pages.

BRASS FOUNDING

THIS DEPARTMENT IS DEVOTED TO THE TREATMENT OF ALL ALLOYS INCLUDING THEIR

FOUNDING, GRINDING, POLISHING, ELECTROPLATING ETC.

PRACTICAL ALLOYING.—XII.

Solders, Novelty Metals and Miscellaneous Alloys.

BY JOHN BUCHANAN.

Besides the alloys in everyday use for castings and those for manufacturing by rolling and other mechanical processes, many metals are mixed and prepared for other important purposes—as solders, tempering baths, plastic metals, fusible metals, shot, dental stopping, anodes for electro-plating, metallic shavings and granulates for steam packing and brazing.

Soldering is the process of uniting two metallic faces by means of a fusible metallic cement. The solders are classed as *soft* or *hard*, according to the temperature at which they melt. Soft solders fuse at comparatively low heats; hard solders fuse only at a red heat. In every case the solder must be more fusible than the bodies to be soldered. As a rule the solder approximates in color, composition and properties to that of the metal to be soldered. Sometimes two pieces of the same metal are soldered by heating the edges by means of a blowpipe and kneading them into one. This is termed *autogenous soldering*, but only those metals that assume a pasty condition before melting, like lead or aluminum, are amenable to this process. Soft solders are graded as *fine*, *medium* or *common*, according to the content of tin. The ordinary soft solders contain only tin and lead, the proportions being varied to suit the work. Table I. gives some of the best examples.

TABLE I.

Parts.		Melts at degrees	Suitable for baths	
Tin.	Lead.	F.	for tempering.	Remarks.
1	25	558	Saws. Springs.	
1	10	541	Watch Springs.	
1	5	511	Hatchets. Planes.	Very coarse solder.
1	3	482	Chisels. Knives.	Common solder.
1	2	441	Razors.	Plumbers' sealed solder.
1	1½	412	Lancets.	Zinc solder.
1	1	370		Tinman's solder.
1½	1	334		Lowest melting point of series.
2	1	340		Fine solder; suits brass, steel, etc.
3	1	356		Fine, hard, tenacious metal.
4	1	365		Common pewter.
5	1	378		
6	1	381		
5	3			Tinning metal for copper.

TABLE II.

PEWTER, BRITANNIA METAL AND FUSIBLE SOLDERS.

Tin.	Antimony.	Copper.	Bismuth.	Lead.	
100	8	2	2		Plate Pewter.
100	17				Best Pewter.
75 to 94	5 to 25	1 to 9			Brit. Mtl.
59			12	29	Fusible Sold.
20			50	30	Melts at 197° F.
30			20	50	Melts at 212° F.

Soft solders for delicate ornamental pieces require to be more readily fused and more fluid than the above alloys. Pewterers must employ solders that melt below 300° F., hence we find alloys for their work contain bismuth, cadmium or arsenic in addition.

Pewter is a tin and lead alloy hardened with small additions of antimony and copper. The best qualities of pewter are akin to Britannia metal, which is a tableware alloy with some resemblance to silver.

The examples in Table II. are given as typical alloys in each class. The wide range of proportions in Britannia metal allows considerable latitude in working the metal by rolling, hammering, stamping, spinning or casting in chills.

The fusible metals become still more fusible when additions of cadmium or mercury are made. Thus, Wood's alloy contains 5 parts bismuth, 2 parts tin, 2 parts cadmium and 4 parts lead, and

fuses at 158° F. Another alloy which melts at the same temperature is Lipowitz's. It contains cadmium 3 parts, tin 4, bismuth 15, lead 8. The alloys are very useful for soldering tin or lead in thin sections, and Britannia metal; also for fine castings, impressions of dies where sharpness is required, and for soldering in hot water.

An alloy for fusible teaspoons is composed of bismuth 8 parts, tin 3, lead 5, mercury 1 to 2. By adding 1-16 its weight of mercury to Wood's alloy, given above, a new compound, fusible at the temperature of the human body, is obtained. Casts are sometimes taken of small animals with one of these alloys. The animal substances are destroyed by a concentrated solution of caustic potash, and the metal remains.

Alloys, or rather amalgams for filling teeth, should melt in hot water and set hard at about 70°. Dentists' alloys for this purpose usually have mercury 74 to 78 parts, cadmium 22 to 26 parts. However, gold amalgams are most in favor for this purpose. Before we leave the fusible alloys there is a novelty in amalgams that deserves notice. It is called Mackenzie's amalgam. This amalgam, which is solid at ordinary temperatures, becomes liquid by simple friction. It may be prepared as follows: Melt 2 parts of bismuth and 4 of lead in separate crucibles, then throw the melted metals into two other crucibles each containing 1 part of mercury. When cold these alloys are solid, but will melt when rubbed one against the other.

Passing now to the *hard* solders, we come to alloys melting in the proximity of 800° F. and upward, and possessing greater variety in color, texture and mechanical properties. Hard solders are prepared in various forms. For the precious metals the alloys are cast into strips, rolled out thin and cut with hand shears, or pressed into suitable pieces, termed "pallions"; but if the surfaces to be joined are inaccessible to these *pallions*, the solder is filed into dust fine enough for all requirements.

Hard solders for gold are composed of gold, silver and copper in proportions to suit the color, hardness and fusibility of the standard alloys, as shown in Table III.

Silver solders are used for all kinds of metals and alloys; steel, brass, silver alloys, gold alloys and German silver alloys. The fine solders contain silver and copper only. Medium solders contain zinc as well. Arsenic and tin are sometimes added to give greater fusibility, and for German silver articles nickel and brass have a place. Zinc is generally introduced in the form of brass, but it is important that the alloy should be free from lead.

The solders are generally used in the

TABLE III.

	Gold.	Silver.	Copper.
For 9 carat gold, according to Gee, the composition approximates	1	2	1
For 14 carat gold, according to Gee, the composition approximates	3	2	1
For 16 carat gold, according to Gee, the composition approximates	9	2	1
For 18 carat gold, according to Gee, the composition approximates	10	5	1
For best solder the composition approximates	25	9	6
For easy melting solder the composition approximates	12	7	3
For very easy solder the composition approximates	Zinc 5½	11½	54½ 28½
For dental articles the composition approximates	Aluminum 2	5	1 1

TABLE IV.

SILVER SOLDERS.

	Silver.	Copper.	Zinc.	Brass.	Tin.	
1	4	1				Ordinary hard solder.
2	2			1		
3	3			1		Tenacious, ductile.
4	5			1		Soft, for fine metal.
5	8	0.5	1.5			Medium.
6	8	0.25	1.75			Easy melting.
7	6	2	1			
8	1	0.75			0.25	
9	32			32	2	Soft.
10	4	1		4	1	Hard.
11	1			1		Common Brass Silver Solder.
12	2			Arsenic 0.25	1	Very easy solder.
13	8	5		" 0.25	0.75	
14	3	1				For steel.
15	2	3	1			For cast iron.
				Nickel.		
16		35 to 45	40 to 57	8 to 12		For German silver.
17		38	50	12		For steel.

form either of fine spangles, dust, granulates, shavings or pallions, and the composition is varied to match the color and other characteristics of the work to be joined. The alloys are all white; numbers 1 to 8 are for fine silverware or ornamental manufactures, Nos. 9 to 11 are for tableware and fine brass articles, No. 12 is for filigree work.

TABLE V.

BRASS SOLDERS.

	Copper.	Zinc.	Tin.	Suitable for.
1	58	42		Copper Pipes.
2	57	43		Brazing Metal Flanges.
3	54	45	1 to 3	Gun Metal.
4	53	47		Light Flanges.
5	50	50		Brass Solder.
6	47	52	1	Brass Solder Fusible.
7	72	18	4	Malleable.
8	46	50	4	Half White. Fusible.
9	58	28	14	White Fusible.
10	24	52	Silver 24	White Fusible.
11	10		" 30	White Refractory, for Steel.
12	5	3	" 2	White Refractory, for Copper.

Solders for Glass and Pottery.

No. 1. Tin 100, zinc 3. Cast into thin rods for use. Heat the edges and apply.

No. 2. Amalgam (70 per cent mercury). Make a soft alloy of tin granulate and copper dust with sulphuric acid, add mercury, wash out the acid when mixed. When solder is to be used heat and knead in an iron mortar and apply when plastic.

Fusible Hard Solders for Aluminum Alloys.

No. 1. Nine parts standard phosphor bronze (no lead), 11 parts tin, 100 parts aluminum.

No. 2. Mix 8 parts standard phosphor bronze (filings), 2 parts tin and 8 parts borax.

No. 3. Alloy copper 3 parts, aluminum 9 parts, zinc 14 parts and granulate. Use cyanide of potassium for a flux.

Soft Solders for Aluminum and Alloys.

No. 1. Zinc 25, aluminum 6, tin 69. Melt zinc and aluminum together and add the tin. Flux with Venetian turpentine or tin the work before soldering.

No. 2. If ordinary soft solder is fused with one-half, one-fourth or one-eighth of its weight of zinc amalgam a more or less hard and fusible solder is obtained, which may be used to solder aluminum to itself or to other metals. Zinc amalgam as used for electrical machines is made by melting 2 ounces zinc in a ladle, then removing from the fire and stirring into it 5 ounces of mercury (previously heated). Stir until cold, then powder it and keep in a tightly corked bottle.

Hard Solders for Brass and Alloys.

By far the most important series of

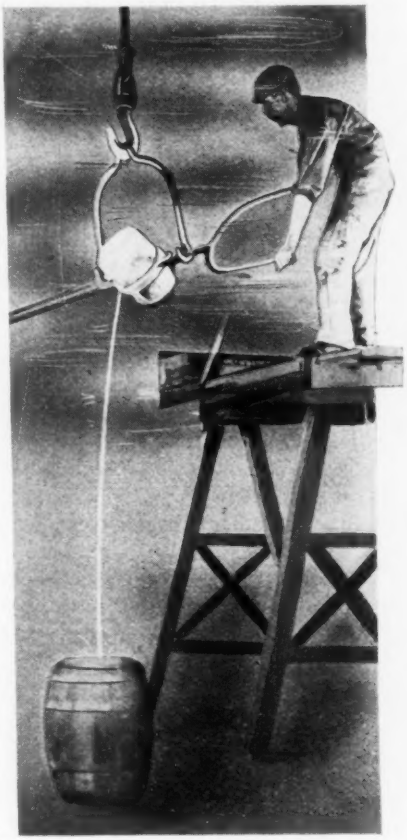


FIG. 1.—GRANULATING BRAZING SOLDER.

hard solders are those for copper and brass—braziers' solders. They go under the trade name of spelter solders—so called because of the high proportions of zinc or spelter in their composition. To make uniform grades of brazing solder requires careful melting and mixing of the proper quality of metals, and they should be poured at the proper temperature. As a rule, portion of the zinc is mixed in in the form of fine sheet or wire brass. The copper-zinc solders have a bright yellow color; a tendency to gray or blue is a sure indication of impurities in the metals, tin, iron, lead.

antimony or phosphorus. Sometimes tin and phosphorus are added to increase the fusibility of the solder. It is always advisable to have the composition of the solder as near to the strength of the metals to be brazed as practicable. Copper, iron, gun metal, and all the brass alloys have different fusibilities and mechanical properties, so that a much stronger joint is made when the solder approaches the qualities of the metal treated.

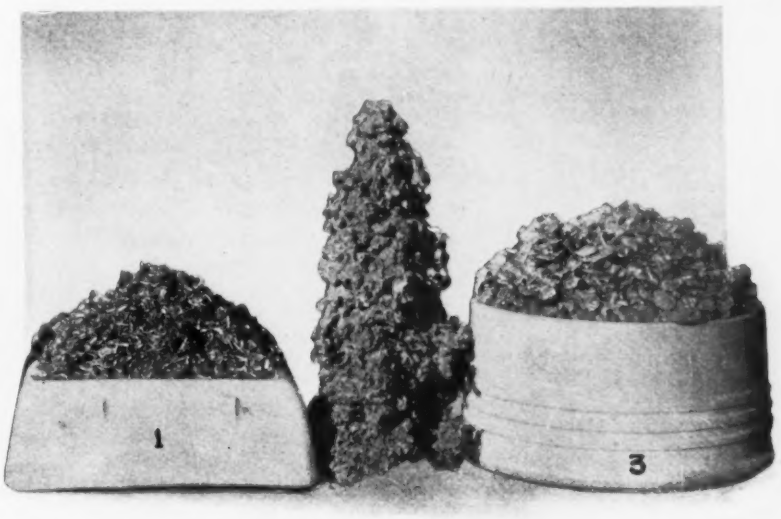


FIG. 2.—BRAZING SOLDERS.

To insure perfect soldering, or brazing, cleanliness is a first essential, and in almost every case the solder and the metal to be soldered are covered with a flux to ward off the oxygen of the atmosphere and to assist in the union of the metals.

Brazing solder is nearly always used in the granulated form, and its manufacture is effected either by pouring the molten alloy from a height, or through a strainer, into water, or by casting it into slabs or ingots and pulverizing it as soon as set. Some manufacturers have machinery for pulverizing the highly heated ingots and the grains pass through screens of several gradations. This gives grains of regular size and a choice of grades for light or heavy work. The discoloration and oxide due to the exposure of the hot metal in the atmosphere is got rid of by dipping the granules in a weak pickle and drying off immediately. But coppersmiths prefer the cast solder before the machine-made article; it seems to stand hammering much better, and it takes less borax to flux it, probably because the grains are globu-

TABLE VI.

NON-OXIDIZABLE BRONZES.

	Copper.	Zinc.	Aluminum.	Phos. Tin.	Bismuth.	Nickel.	Mercury.
1	2	15	80	1			*2
2	2	12	85				1
3	1	8	90			1	
4	88	8	2.5	1.5			
5	85	1	9	4			1
6	90	6	4		0.5		
7	91.5	1.5	0.03	6.7			0.07
8	40	20		14	0.75	27	
9	60	17.25	1	12.5	0.75	8.5	
10	72	22	2	4			
11	24	68	2	6			
12	47	21		1		31	

*Alloys containing mercury, arsenic, antimony or zinc show considerable loss of those elements by remelting, so that care must be taken not to overheat the alloy or remelt it without adding new metal.

lar (Fig. 2, No. 3), while the pulverized is like spangles (Fig. 2, No. 1).

To see the pouring of a heat of brazing solder is to witness one of the most interesting spectacles the brass foundry affords. The metal is granulated by being poured from a height into a tank of clean water. Owing to the high content of zinc a glowing incandescence, some blue haze and a great deal of philosopher's wool permeates the foundry during this operation. You stand open-mouthed gazing at the thin red line as it falls hot from the crucible into a watery grave—no, that is too poetical—a barrel of water is the actual fact. You admire the courage of the caster perched on some rickety, temporary staging, placed on the top of a drying stove or a pile of molding boxes, when suddenly the illumination ceases, the "heat" is poured off, and, feeling a choking sensation in the upper regions of the chest, you rush for the door and miss the best part, which is to see the nice, bright, round grains of metal taken from the tank, washed under the tap and dried off ready for use. Fig. 1 is an attempt to photograph the pouring, but it would require a cinematograph to show the effect of the fine stream of molten alloy hitting the water, the rising steam, the falling smoke, the snow-like ZnO, and the pyrotechnic display. The height from which the metal is poured and the rate of pouring regulates the size of the grains. Twelve feet was the fall in this case.

Sometimes a plumbago strainer or colander is fixed in a frame immediately over the tank; the metal is poured into that and drops through in regular-sized grains. The only objections to this process are the "skulls" left in the strainer and the expense. Another method is to pour the metal upon a cannon ball barely covered with water in a shallow dish. On striking the ball the metal scatters into small pieces and falls into the water. But the finest and most uniform product of all is obtained by arranging a horizontal pipe in connection with a force pump. The cock on the pipe is opened so that a jet of water is thrown across the tank which is to receive the alloy. Upon this jet of water the molten metal is poured. The force of the water may be regulated so as to give grains of a determined size, within certain limits. Some skill is required in the pouring by all of these methods if uniform grains are desired. The metal must fall in a regular, thin stream, otherwise on emptying the tank, conglomerate similar to No. 2, Fig. 2, will result.

In no case should the solder be left overnight in the water; it should be dried off at once to avoid unnecessary oxidation, and for the same reason it should be kept in air-tight tins. Any attempt to pour a second heat into the same water would result unsatisfactorily. The oxides from the first pouring, which gather like a scum on the surface of the water, and the heat of the water itself would be fatal to the best results.

The average composition of brazing solders varies between copper, 58 to 40 parts, and zinc, 42 to 60 parts, the fusibility of the alloy being in proportion to the amount of zinc present, 1,150° F. being approximately the melting point of No. 5.

For those who prefer to use mixed

TABLE VII.

MISCELLANEOUS ALLOYS.

	Copper.	Nickel.	Silver.	Aluminum.	Tin.
Rozine for jewelry, No. 1	43	32	25		
for jewelry, No. 2		40	10	30	20
for castings, No. 3		3		87	10
for castings, No. 4	1	3		96	
for springs, No. 5			6	94	
New Bell Metal	87			2	11
		Lead	Antimony		
Acid Bronze	76	9	5		10
			Cobalt		
Cobalt Bronze	40		50	10	
			Manganese		
Heusler's Magnetic Alloy	85.5	0.5	16	8	
			Zinc		
Brass to expand by equal heat with iron (Bolland)	79		15		6
		Nickel		Platinum	
Platinum Bronze	42	31	22	5	
Platinum Bronze		100		0.5	15
Anti-rust alloy for stop cocks	7		72		21
Anti-friction brasses	5	1	80		14

metals a convenient mix for brass solder is to melt 30 to 40 pounds brass, wire or sheet, and add in 10 pounds of virgin zinc. Copper tubes are now manufactured having from 2 to 3 per cent aluminum alloy. The British admiralty adopted the use of these for steam pipes and copper fittings, because of the relatively high tensile strength and the advantages offered by increased burdens, or the diminution of weight in similar structures. An excellent blowpipe solder for this class of work is M. Mourey's: Tin 6 parts, zinc 3 parts, aluminum 2 parts, copper 1 part, silver (optional) 1 part.

TABLE VIII.

		Copper.	Nickel.	Magnesium.	Aluminum.	Tin.	Zinc.
Strong	No. 1	1.76	1.16	1.60	95.45		
Soft. Rolls well	No. 2	0.21	0.3	1.58	94.0	3.15	0.72

Novelty Metals.

About the middle of the nineteenth century the introduction, for a set purpose, of the metalloids in metallic alloys, constituted a novelty in practical alloying. Later, when aluminum became a comparatively cheap product, several new series of useful and novel alloys made their appearance, and with the advances of electrical engineering, the conductivity and magnetic power of metals and alloys were put into new relations. The latest novelty to be recorded is the commercial production of some alloys by electro-deposition. There is still ample scope for the invention of new alloys and more scientific methods of making and manipulating them, and it is along these lines that the best work will yet be done. Some metals in alloys suffer from over-popularity, viz: Aluminum, lead, phosphorus, zinc, etc. Aluminum, because of its low specific gravity; lead, because of the weight and economy of its use in alloys; phosphorus, because of the fusibility and over-rated refining influence it has on dirty metals, and zinc, because of its cheapness and toughening effect in other metals. The abuse of these metals is well known to those who handle ready-made alloys for the production of castings. Food supply houses have no prerogative for the use of adulterants.

Time was when phosphor bronze was held in high esteem, but now, because of the indiscriminate use of phosphorus and lead, it has fallen out of line. Aluminum was all the rage for a while as a mixer, deoxidizer, strengthener and cure-all in iron, steel, copper and alloys, but it was over-exploited in these particular lines, and the true, legitimate uses of the metal are only beginning to be found out. Perhaps the art section of modern industries is responsible for more of the novelty metals than any other branch.

Metals have always been in use for ornamentation, but the artistic influence of alloys in recent times has tuned up the general style of decorative metal work, and bright chromatic effects are giving place to the solid, old-fashioned, monotonous design of the wrought-iron period. With alloys we can have lightness, cheapness, elegance, strength and variety of color scheme combined in the newest art.

A new argentan which resembles silver and may be worked like German silver contains copper 70 parts, nickel 20 parts, zinc 5.5 parts and cadmium 4.5 parts. Some cheap alloys, fusible, white, close-grained and in every way suitable for casting objects of art are made as follows: Melt 3 parts of tin in a crucible, heat 2 parts mercury in a hand ladle and add carefully to the barely molten tin; pour out into ingots. Add 5 per cent of this tin-mercury alloy to the ordinary aluminum-brass mixture (=copper 57, zinc 42, aluminum 1). The resulting alloy has a beautiful pale pink color when polished, and it may be used alone or as a hardening composition in white metals.

One mixture which has the advantages of small shrinkage and high luster consists of one part of the hardening to two parts of zinc. Approximate analysis showed the finished proportions to be: zinc 81.48, aluminum 0.40, mercury 0.72, tin 1.0, copper 16.22. Other non-oxidizable metals containing mercury are given in table VI.

These alloys vary in color from white to a deep golden hue. Nos. 1, 2 and 3 are: Aluminum alloys with the luster of silver and considerable hardness and elasticity. Nos. 4, 5, 6 and 7 are varia-

tions of the ordinary bronze alloys. Nos. 8 and 12 are nickel bronzes—hard and sonorous. No. 9 is still white and malleable.

Special Antifriction Lining Metal—tin 53, lead 32, copper 3, antimony 11. Melts at 295° F. Specific gravity, 7.23.

E. Murman's Improved Magnesium—aluminum, 100 parts; magnesium, 1 to 10 parts; zinc, 1 to 20 parts. The zinc overcomes the difficulty of obtaining sound castings and the tenacity is not reduced.

Gun metal for Piston Rings and Springs—copper 83, tin 10, zinc 7. Very elastic.

Cheap White Alloy for Art Castings—aluminum 78, zinc 12, copper 8, tin 2. Fine luster.

Red Brass for Fine Ornamental Castings—copper 82.5, zinc 16.25, bismuth 1.25.

Hard Solder for Bell Metal—brass 40, copper 10, tin 15.

Hard White Brass—tin 67, antimony 11, copper 22.

Alloy for Scientific Instruments (named Zisikon)—aluminum 80 parts, zinc 20 parts.

New Magnesium Alloys are coming into use, and the composition of two is shown in Table VIII.

FROM ROUGH CASTING TO FINISHED PRODUCT.

By H. J. Hawkins.

When the castings have been properly pickled, the next operation is grinding and polishing, for removing the gates and uneven and rough projections. This first operation is usually performed with a solid emery wheel running at a speed not to exceed 1,200 revolutions. We are dealing now with articles which are to be finished as polished brass.

The second operation, or it may be the first if the castings are particularly smooth, is accomplished by the use of the roughing out wheel, which is usually a heavy canvas wheel set up with glue and emery of the necessary coarseness, about No. 60 to No. 80 being the best for this operation. Home made roughing wheels are often made by fastening together the required thickness of stitched muslin buff sections, using wide leather washers with the proper sized arbor hole and wire nails to do the fastening. Use a mandrel or piece of iron pipe that just fits the arbor hole, place on end, slip over one washer, then the buff sections and then the other washer. The nails are then driven through and clinched, glue is sometimes spread between the sections to make it more solid before the wheel is nailed together. A wheel of this kind is often preferable to the commercial canvas wheel which is usually not very flexible, while the home

Fig. 1.

made wheel is soft and pliable, being particularly adapted for roughing out angles and other odd shaped castings. The polishing lathe, upon which all the polishing wheels are run, should run much faster than the emery wheel. The average speed for polishing and buffing being about 2,500 revolutions, higher speed is sometimes used in polishing certain classes of work. After roughing, the work is run over a grease wheel which is a partly worn roughing wheel to which is applied oil and tripoli, smoothing the surface with a polishing stone. This wheel removes the rough emery marks from the work and makes easier the buffing operation.

For fast cutting sewed buffs are used (see Fig. 1), they being much harder than buffs not sewed. Tripoli cake is used with such wheels. Size of wheel and speed are things that must be taken into consideration in buffing. With a 14 to 16 inch buff running at a high rate of speed, brass work may be buffed and finished much faster than with an 8 to

10 inch buff running at the same speed.

So it is not always economy to require a workman to use a wheel after it has been reduced to a certain size; especially is this true where large work is being polished. There is always a use for these partly worn wheels in buffing smaller and smoother work that does not require the labor that the larger and rougher work does. These small wheels are also sometimes cleaned out with an old file and used as a finishing buff for either brass or nickel.

Buffing or coloring is the last operation on the wheel if the work is to be finished in brass. It is then ready for lacquering.

FIG. 2.—POLISHING STAND.

If it is to be nickel it goes to the nickel bath and is again buffed after plating. In buffing or coloring brass, loose muslin buffs are used, softer and smaller in size than those used with tripoli for the cutting down operation. There are several compositions used in color buffing. Rouge, crocus and several white metal polishes. These last are made for the different classes of work and are used most extensively because of the beautiful finish they impart to the work and because matted backgrounds and filigree work are easier cleaned than when finished with either rouge or crocus.

In cleaning matted or flowered parts after color buffing, I have always found Kalye to be much superior to potash or lye, as it does not readily tarnish and discolor the work. A good buffer is always able to turn his work over to the lacquer room directly without any washing or cleaning; that is, plain work without too much background or matted work.

In recent years there have been some valuable improvements in polishing machines. There are one or two ball-bearing machines on the market, which, while the first cost is more than the ordinary machine, it more than makes up the difference in satisfaction and lasting qualities. The accompanying cut, Fig. 2, shows a machine that is in general favor among manufacturers where large and odd shaped pieces are to be polished, requiring extra room in which to swing the work.

The Fowler Brass Works, Chicago, has increased its capital from $25,000 to $50,000.

The iron and brass foundry for the Calumet & Hecla mine at Houghton, Mich., is now under construction and the building will be enclosed before winter.

The Duluth Brass Works, Duluth, Minn., expects soon to double the size of the building it now occupies, having purchased the adjoining lot.

George Stewart is organizing a company for the operation of a brass foundry in Marion, Ind. The capital stock will be $20.000 and it is expected that the company will be ready for business in a short time. Brass fixtures and novelties will be manufactured.

The D. T. Williams Valve Co., Cincinnati, O., is installing equipment in the large seven-story building which it recently purchased and expects to occupy it March 1. It will then have about six times its present capacity for manufacturing steam valves, lubricators, oil cups and engineering specialties.

Foundry Department of the Lunkenheimer Company, Cincinnati, O.

The products of the Lunkenheimer Co. of Cincinnati, Ohio, are known throughout the entire engineering world as of the highest quality and hence it is but natural to suppose that such a firm would have a foundry in keeping with its reputation. A visit to the plant shows that just as careful work has been bestowed upon each detail of the manufacturing equipment as upon the design of their large line of high grade products.

ONE OF THE MOLDING FLOORS.

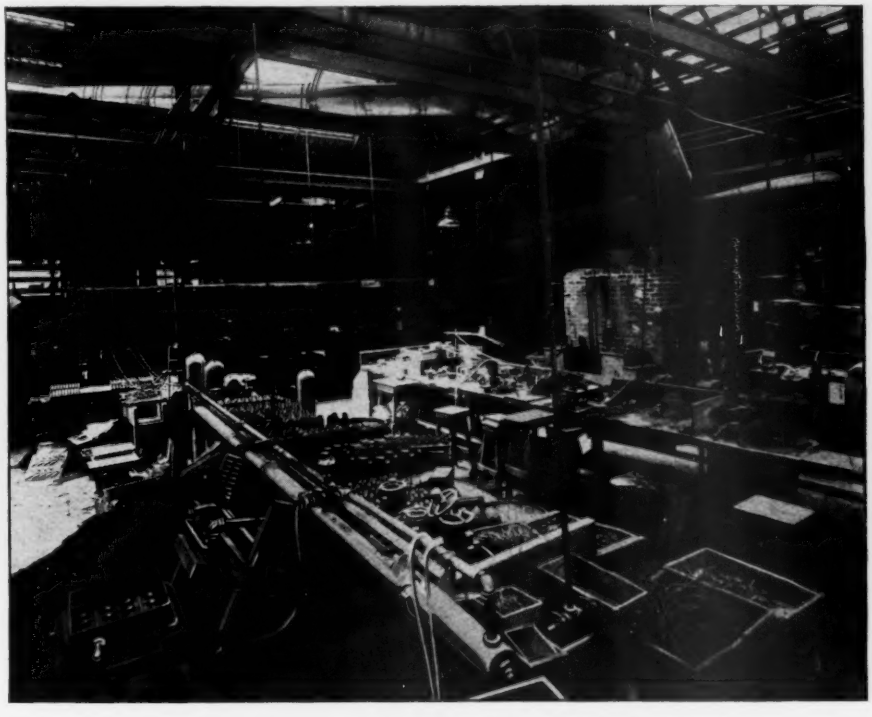
It is well known that the quality of material used in the manufacture of Lunkenheimer products is maintained at the highest standard of excellence possible, the reason for which can be attributed to a most complete chemical and physical laboratory which controls the foundry department and has in charge a corps of experienced chemists and engineers. This department enables the company to furnish any particular composition desired and they are therefore perfectly safe in guaranteeing their products. The laboratory contains complete apparatus for analyzing, a furnace for experimenting on new mixtures, hydraulic and steam testing apparatus, and an improved make of machine for testing the compression and tensile strength of materials.

The pattern shop, of course, is a leading factor in the maintenance of a foundry productive of high grade goods. This department of the Lunkenheimer Co. is equipped with all the machinery necessary for the production of both wood and metal patterns. The majority of the patterns and core boxes, however, are made of metal,

not alone because of the tremendous amount of handling they are subjected to, but also to maintain a uniformity in the castings. All of the small parts of their standard products are secured to plates and are used on molding machines of which the company have quite a large number.

A magnificent example of the pattern maker's art is shown in the core boxes for globe valves. As constructed, the parts require great accuracy in fitting, and the diaphragm, which is a curve, is arranged to draw out through stripping plates. While the amount of skill and labor required to make a core box of this improved design is quite an item, nevertheless the facility and speed with which these difficult cores are made, together with their uniformity, soon pays for the expense incurred.

The pattern storage occupies quite a large room adjacent to the foundry. The large number of patterns and core boxes stored in this room naturally requires a good system of filing, otherwise endless expense, time and trouble would result in locating them. The system which the Lunkenheimer Co. have adopted, enables the attendant in the pattern room to immediately locate any core box or pattern required. The shelves containing the patterns are carefully numbered and by referring to a card system, the exact location of an article can be immediately ascertained. The attendant only is permitted to handle the patterns and core boxes and consequently there is no danger of their becoming misplaced.



ONE SECTION OF THE CORE DEPARTMENT.

Orders for castings are issued from the office to the pattern attendant. Two racks are provided in the pattern room, one for core boxes and the other for patterns, and the work is taken from these racks by the foreman of the core room or foundry. When a core box is taken off the rack a card is left in its place which indicates that the cores

are ready and the foreman of the foundry is therefore safe in taking the pattern.

In a foundry making a specialty of valves, whistles and other engineering appliances, cores play a very important part, and hence the core department of the Lunkenheimer Co. is quite a large one. This department is divided in two parts, one for the lighter class of cores and the other for the large sizes. The core room is equipped with four Millett core ovens arranged in a group and heated with crude oil by means of a special burner. There is also a larger core oven which is intended for the extremely large cores. The core sand is mixed in a special department by a Sellers machine, and this department also contains a Gould & Eberhardt rotating screen. As some of the cores are very complicated and difficult to make, while others are plain, different kinds of special compound are used as a binder for the core sand. A Nobles magnetic separator is used to remove nails, wires and other iron substances from the brass spillings gathered from the foundry floor.

A very large force is employed in the foundry, the majority of which, however, are placed in the molding department. Owing to the large amount of plate work, the molding department is equipped with quite a number of molding machines. Each machine is operated on the gang plan, that is to say, the machine is operated by one man who is assisted by a number of others. The assistants aid in carrying away the molds, arranging them, mixing the sand, etc., thereby permitting the man at the machine to work the same to its maximum. All of the intricate work is molded by hand, and owing to the large amount of special work manufactured by this company, there is a large bench force employed.

THE CLEANING DEPARTMENT.

The melting or furnace room is located directly adjacent the foundry or molding department and consists of fourteen large oil furnaces of an im-

proved design which have been developed by the Lunkenheimer Co. and which were described in THE FOUNDRY about a year ago. There is also a battery of twelve coke furnaces for special mixtures, or to be used in case the oil supply should be interrupted. The air blast for the furnaces is supplied by two Root blowers and the crude oil, which is kept in underground tanks across the street, is heated to from 140 to 160 degrees F. by being pumped through a heater whence it is forced to the furnaces. It is stated that melting with these oil furnaces costs less than half what it would with the coke furnaces and that the total loss through melting is less than three per cent. The metal is conveyed to the molding department by means of ladles suspended from a trolley track system. The pouring of the metal into the molds is done by a special gang which does nothing else and takes all of this work off the molder's hands. By this means, the molder is enabled to considerably increase his day's output.

The cleaning department must needs be a large one owing to the enormous amount of small work cast. It is equipped with metal band saws, power sprue cutters, double grinding stands, and all other machinery necessary for trimming and cleaning the castings. A very interesting feature of this department is the use of the sand blast, which is employed for removing the cores from the interior of such castings as would otherwise be very difficult to clean. A powerful exhaust fan removes the dust and dirt from the room in which the sand blast apparatus is located. The exterior of the castings are cleaned in sand blast tumbling barrels.

When cleaned, the castings are conveyed to a department where they are sorted out and put in stock to be distributed later to such departments as require them.

The method of recovering the waste products in this plant is interesting. All of the metal chips from the various departments are shoveled into hoppers on the different floors of the factory and fall through a chute into a bin on the lower floor. The chips are first put through a large half-inch mesh riddle, which removes all large pieces of metal, both iron and brass. The large pieces are then sorted over and separated into their proper grades. The chips are then put through a Dings electro-magnetic separator which removes all of the iron and steel. One of the melting furnaces in the foundry is used continuously for melting chips and is run with a reducing oil flame as far as possible and a mixture of quick lime and fluorspar is used as a flux. The metal is only heated to a temperature sufficient to pour into ingots. The composition of the ingots is determined by analysis.

THE SAND BLAST ROOM.

The skimmings and shot metal are ground in an ordinary grinding pan with a good flow of water which washes away most of the sand and impurities. The material is then taken to an inclined table where it is washed with a jet of water, the operator continuously shoving the material up before the jet until pure metal results.

This metal is then returned to the furnace with the chips.

A portable pneumatic sand sifter is one of the handy devices used in the foundry. The sand is tempered and shoveled into it after which the device is conveyed to the molding bench and the sand dumped out ready for the molder.

The Lunkenheimer Co. have adopted a very interesting system of calling the various heads of departments. The party in charge of the private telephone exchange has also charge of a small key board which electrically operates signal whistles located in all of the buildings. As all of the heads of departments have a particular signal, it is only necessary for the operator to give this signal, when the party desired will immediately go to the nearest telephone and answer. He is then put in communication with the party wishing to speak to him.

To facilitate the transmission of messages and orders throughout the factory and office buildings, a pneumatic tube system has been installed.

The plant is heated and ventilated by the Sturtevant system.

BRASS OR BRONZE?

BY J. F. BUCHANAN.

In the June issue of THE FOUNDRY some interesting analyses of "Brass and Bronze for the Automobile" appear. Mr. H. B. Depont, the author of the article, adds "a few specimens of analyses to promote a little discussion as to which particular class they belong." Numbers 3 and 4 contain

	Copper.	Tin.	Zinc.	Lead.
No. 3.....	83.12	6.16	10.38	1.12
No. 4.....	81.94	8.8	5.00	4.22

and Mr. Depont comments upon them thus: "Numbers 3 and 4 are brackets for radiators. No. 3 by its high zinc is entitled to be classed as a *brass*, but No. 4 will go into the *bronze* class." I think this classification is unfortunate. Both of these alloys are in the class familiarly known to the trade as *steam metal*. Why should a copper alloy which contains 5 per cent zinc and 13 per cent tin and lead go into the bronze class, while another metal higher in copper, with 20 per cent less lead and only 10 per cent zinc is entitled to be classed as a brass? Where does the dividing line which marks off *bronze* from *brass* occur?

For many years I have been girding at the abuse of terms employed to describe copper alloys. It is high time some technical classification was devised which would be a guide to the tyro as well as a convenience to the practical worker in alloys. Such a method I offered in an article on "The Notation of Alloys," February, 1906. Briefly my method is to adopt a rational system of labeling alloys by taking the initial syllable of the metals they contain and forming a composite word by which the components and also the proportions may be known. For example, No. 3 above would be named

$$Cu_{83.12}Zi_{10.38}Stan_{6.16}Plum_{1.12}$$

No. 4 would be called

$$Cu_{81.91}Stan_{8.5}Zi_{5.00}Plum_{4.22}$$

There the metals and the proportions are clearly indicated in a convenient form for all technical and commercial purposes. Disputes as to whether a gun metal was brass or bronze would cease and attention would be directed to the details of alloying and settle the most desirable combinations for any class of work.

BRASS FOUNDRY NOTES

BY C. VICKERS

ROUGH CASTINGS FROM SCRAP METAL.

Inquiry.—When using scrap metal (brass) we find that many castings are very rough, particularly on the inside of valve and cock bodies. We should like to know if there is any core wash which can be used which will prevent this roughness.

Answer.—In order to give an intelligent answer to the above query the following information should be known, viz.: The kind of sand used in making the cores. Whether any binder is used, and if so what? Do

the castings come rough when made from new metals?

Although from the tone of inquiry I infer that they do not, as it states "when they use scrap," I find it difficult to believe that any given core, should produce a smooth casting when the alloy was made of new metals, but turn out rough work when old metals are used.

If this is what happens, there is something in the old metal, that gives it such fluidity that it eats into the core. There is only one substance that I know of which causes this, and that is phosphorus.

If the scrap is phosphor bronze, of the old fashioned sort, rich in phosphorus, and high in lead, and handled by anyone unskilled in the casting of such metal, the results will be castings, rough, both inside and out, when the "green sand" forms the mold as well as in the cored parts.

We will imagine this is the case as being one point from which to view the query and also a very probable thing to happen to anyone.

A good way to overcome such trouble would be to dilute the phosphorus by using a certain percentage in each heat of new metal, and pour the castings as cool as is consistent with running them perfectly. The new metal used should be principally copper as a phosphor bronze such as we are considering, would be too hard an alloy for such castings as valves or cock bodies. A few trials should determine the above points.

I notice the inquiry is from an English correspondent, and for that reason is more difficult to answer satisfactorily, without a knowledge of the kind of sand used in the cores.

In the writer's time, we used two kinds of sand for core making in English foundries, viz., "Mansfield" and "Doncaster," these sands may be now obsolete or worked out, as this was some years ago. They were both bright red sands, "Doncaster" being the coarser. We used to mix these sands together, in varying proportions, to suit the requirements of the various kinds of cores, and grind them in a mill, sometimes adding a little loam. We made cores of all kinds out of these sands, without binder, and without vents. The sand was so strong, we could with ease, take cores out of their boxes, which, on this side the water, would call for dryers.

When we desired very smooth work, we would coat the dried core (it was only necessary to dry them) with whiting rubbed on dry with the palm of the hand, and dusted with a soft brush, to remove any surplus. The castings came as smooth inside as out.

Obviously our correspondent does not use these sands, or he would not be having trouble, so we come to the subject of core washes. For globe valves and such work, I have used liquid whiting with success; to coat the cores, we mixed a pail of whiting and simply dipped the cores, after they had been dried and pasted together. By this means the joints were filled, and fins prevented which is important on such work. To prepare the wash, to one ordinary pail of water, add ½ pint of black molasses and stir in sufficient whiting to make a whitewash.

The cores should be suspended with thin wire, and when dipped threaded onto a bar and run into the oven to dry. Plumbago, may also be used in place of whiting, but it will have to be put on with a brush, because the coat must be thick or it is of little protective value.

Especially is this the case when a core is set in a heavy mass of bronze. Unless the core is well protected the bronze will penetrate the core, filling the cavity with a mass of sand and metal very difficult to remove. Such cores must be coated with plumbago, not washed on, but rubbed on in the form of paste, and polished by rubbing over gently with the hand; this gives a heavy smooth coat impenetrable to the metal, and effectually protects the core, producing a smooth hole. The best form of binder to be used for valve body cores, etc., is oil,

which will produce a smooth interior without any coating, all that is necessary being to fill up the joints, so there are no fins around the seats of valve. For this purpose as aforesaid we used whiting; plumbago in paste, is also used, but takes more time, as it must be rubbed into the cracks.

For a good core composition for this work, take:

Of old molding sand (sweepings, etc.), 5 pounds by weight, lake or other sharp sand, 7 pounds by weight, temper with water, making a little dryer than to be used, then add, 6 ounces linseed oil core compound.

COCK AND BIBB METAL.

Inquiry.—Kindly favor us with a few good mixtures of cock metal, both red and yellow, to be made up entirely of scrap metals, also bibb compositions, both red and yellow. We assure you the favor will be greatly appreciated and trust you are in a position to give us some information along this line.

Answer.—The question naturally arises, how far is the use of scrap metal to be carried in these alloys? Scrap copper is in general use, but the alloying white metals are commonly new, with the possible exception of lead, as this metal does not change greatly by exposure to the atmosphere. Scrap zinc exists as old sheet zinc, clippings, etc. It is often very dirty and therefore produces much dross when melted, so founders who buy this material generally first run it down into ingots, when for the purpose of making alloys it may be considered as new zinc.

When sheet zinc is added to melted copper to form brass, it should be pounded into compact masses, never charged loose, or the greater part will pass up the chimney or fall into the fire, because when the heat strikes a thin sheet of zinc it wilts and the poker passes through it instead of meeting sufficient resistance to enable the sheet to be pushed into the copper. The zinc immediately deflagrates, the fierce white light and smoke effectually concealing the crucible and rendering further operation mere guess work.

Therefore the use of scrap zinc cannot be viewed as much of an economy to the brass founder and in the following mixtures, where zinc is mentioned, new zinc or scrap zinc run into ingots is intended to be used. The melting of scrap copper, particularly thin wire, requires care and constant attention on the part of the melter or the casting will be spongy. This point cannot be too strongly emphasized.

Generally, the use of scrap brass is in the line of economy, though there are exceptions. For instance, where the cost of a casting is overshadowed by the cost of finishing, it always is cheaper on a large order, to use new metals, because a clean, free cutting alloy can be used, the extra cost of which, per pound, over scrap, is lost sight of in the saving effected by its free machining qualities. With scrap brass we cannot be certain of its composition. It may contain iron, be unexpectedly hard or tough, necessitating constant trimming of tools.

The following alloys will offer a chance for selecting something suitable for the work in hand.

Red Brass.

(1.) Copper, 25 pounds; zinc, 4 pounds; lead, 1 pound; tin, 1 pound; scrap brass, 25 pounds.

(2.) Copper, 50 pounds; yellow brass, 20 pounds; lead, 5 pounds; pewter, 1 pound; scrap brass, 24 pounds.

(3.) Copper, 50 pounds; zinc, 10 pounds; lead, 5 pounds; yellow brass, 30 pounds.

(4.) Copper, 50 pounds; yellow brass, 25 pounds; lead, 5 pounds; scrap brass, 20 pounds.

(5.) Copper, 56 pounds; yellow brass, 12 pounds; lead, 4 pounds; tin, 4 pounds.

Where scrap brass is mentioned, red brass scrap is intended to be used.

YELLOW BRASS ALLOYS.

(1.) Copper, 20 pounds; zinc, 10 pounds; lead, 1 pound.

(2.) Copper, 20 pounds; zinc, 7 pounds; lead, 1 pound; tin, 1 pound.

(3.) Copper, 35 pounds; zinc, 15 pounds; lead, 1 pound; tin, 1 pound.

(4.) Rolled yellow scrap, 50 pounds; zinc, 10 pounds; lead, 3 pounds.

A CORE WASH.

Inquiry.—I would like to know of a good gum wash to put on cores for heavy brass work.

Answer.—There is nothing better for this purpose, in my opinion, than a heavy coat of good plumbago; I prefer to put it on the cores, in the form of paste, and afterwards lightly polishing. It may also be used as a wash, but for heavy work two or three coats will be necessary.

Molasses is generally used to cause the plumbago to adhere to the core, but gum may be used if desired, though I do not think it possesses any points of superiority to common molasses.

MOLDS FOR CASTING TYPE METAL.

Inquiry.—I desire an alloy suitable for making molds which are to be used for making small castings of type metal. The alloy should melt at a low temperature, say about that of zinc, but it should be hard and durable enough to serve as a permanent mold for making the above castings.

Answer.—I have had no experience in casting type metal, in white metal molds, and am skeptical as to whether it can be done. You might try aluminum; however, I throw this out, merely as a suggestion, as I have never tried it.

Permanent molds are usually made of iron or bronze, and I think you will find it cheaper in the long run, to use one of these metals for your molds.

MELTING BRONZE.

EISEN-ZEITUNG, No. 37.

It is well known that the tin contents of a bronze is especially liable to oxidation, and hence the quality of a remelted metal suffers greatly thereby. Copper likewise becomes oxidized, but not in so great a measure. There are two principal reasons for this trouble. Gases which are formed dissolve in the bath of the molten metal, and the action of the air coming into contact with melt in the process itself, or in the mold. These gases are carbonic oxide, hydrogen, and sulphurous acid, the latter from the fuel used in melting in the air furnace. This gas comes out as the metal cools, and can be recognized in the rising of the metal. The worst enemy of the melting process is the solution of the sub-oxide of copper formed by the oxidation of the copper in the bronze, in the bath. To remove this the use of phosphorus is resorted to. It is important that only so much of this deoxidizer is used as is necessary to remove the oxidation, as an excess is not desirable; 0.5 down to 0.1 and even lower should do the trick. Phosphorus is best added in the shape of a phosphor-tin alloy. Lead is also added to promote ease in casting. It is probable that this metal volatilizes and in leaving the bath carries with it the occluded gases. 0.4 down to 0.2 is sufficient for the purpose and is added just before pouring. To get the best results it is also necessary to prevent the access of air as much as possible to the metal, and hence a covering of charcoal, or better still, of powdered anthracite should be used.

The Macungie Brass & Mfg. Co., Macungie, Berks county, Pa., is erecting a new foundry.

The E. Stebbins Mfg. Co., Springfield, Mass., expects to have its new brass foundry completed before Jan 1. The building, for which the foundations have already been laid, will be 55 x 84 feet.

The Piqua Flour Co., Piqua, O., has purchased a tract of land 115 x 310 feet, on which it expects to build a plant which will give it a capacity of 10,000 barrels of core flour monthly.

The Kennedy Valve Mfg. Co. has let contracts for its new plant at Elmira, N. Y., including an iron foundry, machine shop, pattern shop, pattern storage building and several other structures. When the new buildings are completed the company will move its plant from Coxsackie, N. Y., and will probably require considerable new equipment.

THE PATTERN SHOP

A PISTON VALVE CYLINDER PATTERN.

By H. J. McCaslin.

Piston valve cylinders, as the name implies, are cylinders in which the steam is controlled by a piston or cylindrical valve, moving in a barrel or chamber parallel to the bore of the cylinder. The example illustrated and described in this article is a pattern for a 32 x 36 cylinder of the above mentioned design. This cylinder is for use in connection with a heavy duty reversible engine. Fig. 1 shows a half plan of the cylinder and a half section through the axes of the cylinder and the steam chest, showing the plan of one port, relief valve opening, etc. By examining the plan view it will be observed that the cylinder is symmetrical about the center line A-A.

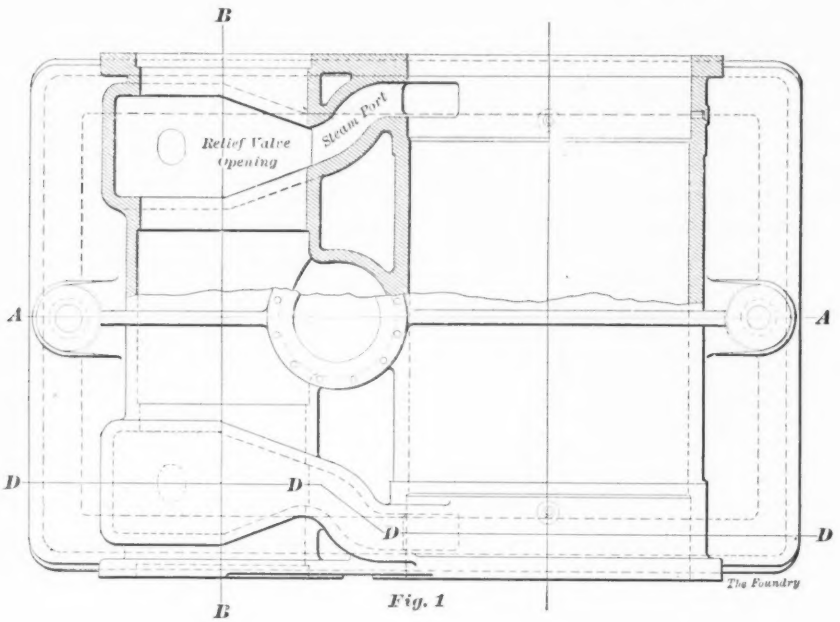


Fig. 1

A half elevation of the cylinder as seen from the steam chest side is shown in Fig. 2, together with a half cross section on the line B-B of Fig. 1. This section shows the metal thickness, etc. A cross section of the cylinder and steam chest on the center line A-A of Fig. 1 is shown in Fig. 3. This section serves to show the exhaust chamber, relief valve connection and bolting down lugs. The end view of the cylinder is shown in Fig. 4.

Before commencing the construction of any part of the pattern its position and method of molding must be determined. Having chosen a horizontal position for the pattern under discussion, it must be parted through the axes of the cylinder and steam chest on the lines C-C, Figs. 3 and 4.

In beginning the work a full size lay-out or a partial lay-out is essential. As the cylinder and steam chest are symmetrical about the center line A-A, Fig. 1, it is only necessary to draw a one-half lay-out of the plan, with the outline of the steam ports, etc., also a cross section as shown in Fig. 3, these two layouts being sufficient. The assembled and completed pattern is illustrated in plan and elevation in Fig. 5, being shown in a reverse position to that in which it is molded, this being the position the pattern occupied during assembling.

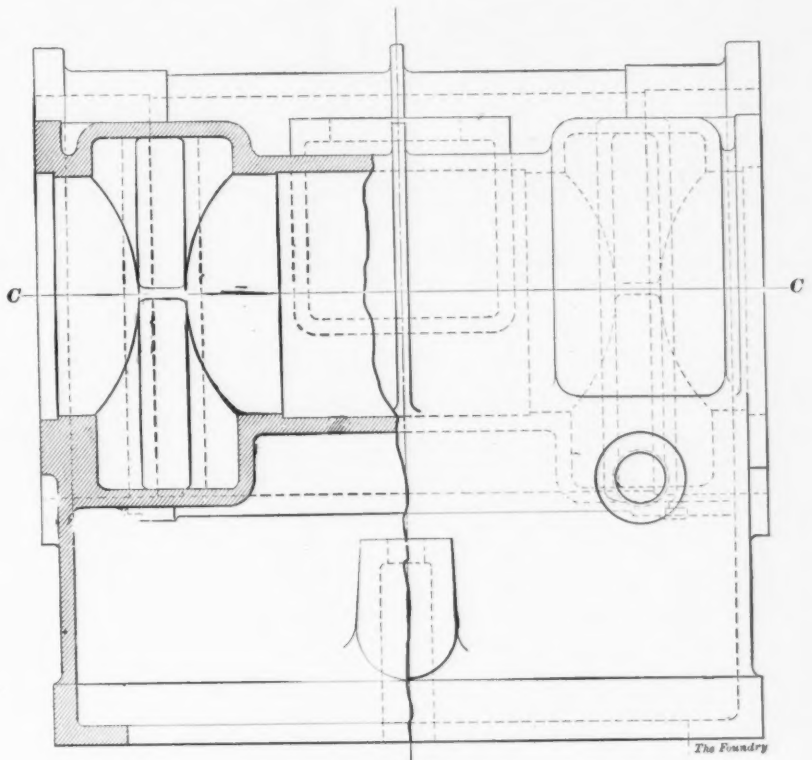


Fig. 2

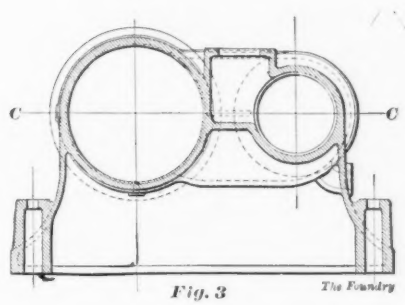


Fig. 3

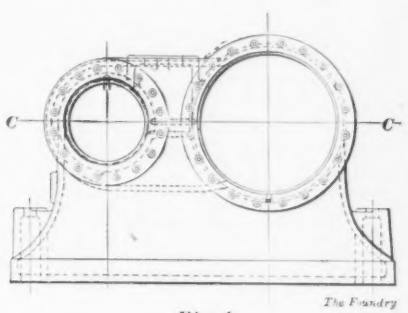
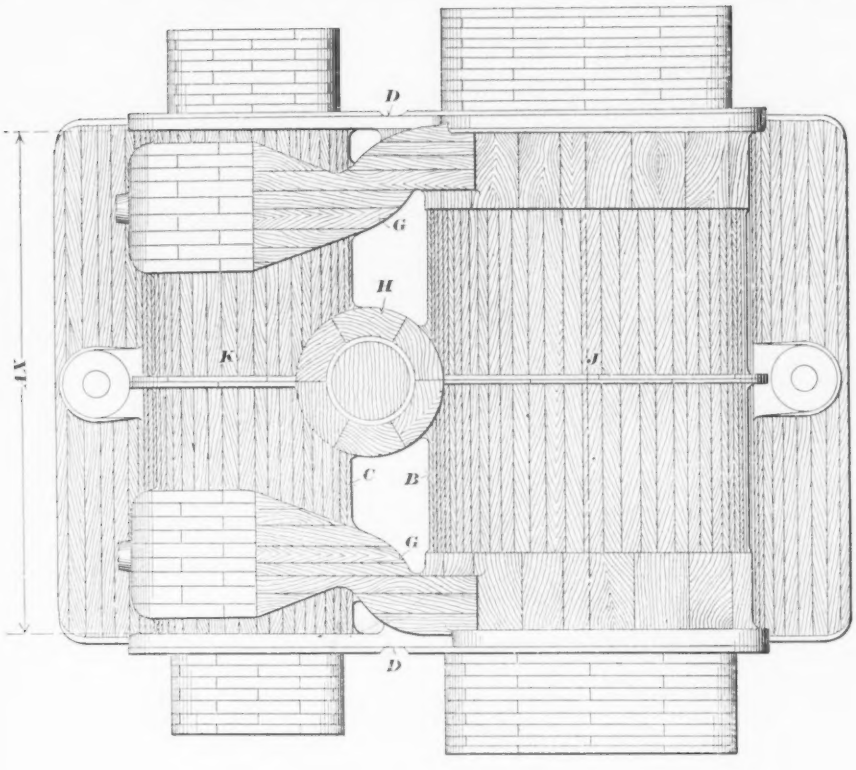


Fig. 4

For convenience in referring to the separate parts of the pattern during its description let us designate them as A, B, C, D, etc., as shown in the completed pattern Fig. 5.

Part A of the pattern is shown in plan and cross section in Fig. 6 and



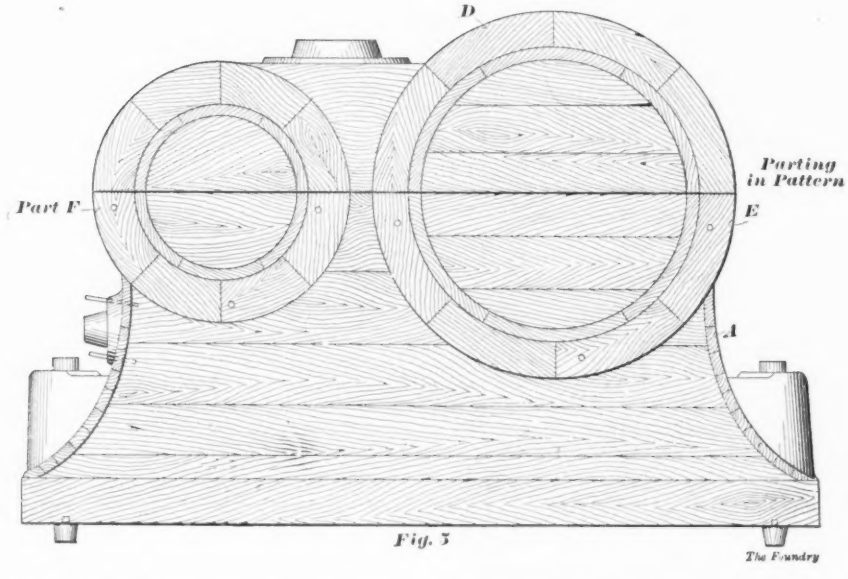


Fig. 3

The Foundry

consists of the lower part of the base of the cylinder. This can be constructed somewhat after the manner shown. It will be observed by examining Figs. 2 and 3 that one-half of the cylinder and steam chest is contained in this part of the casting, being of course formed by the core. In commencing part A, three frames are gotten out, being nailed and glued to-

gether in a manner similar to that employed in the construction of segment work, that is, each frame is composed of three thicknesses of material. The two frames which form the ends of the base are covered or closed in with the proper thickness of material. After this is done one frame is laid out and sawed to the proper form of the base, less the thickness or lagging thickness and in narrow strips. It is then nailed and glued in place, when it will require but a small amount of dressing with a round sole plane, followed by the usual application of sand paper.

Next the center lines of the cylinder and steam chest and of the bolting down lugs are carefully and accurately laid off across the parting of the

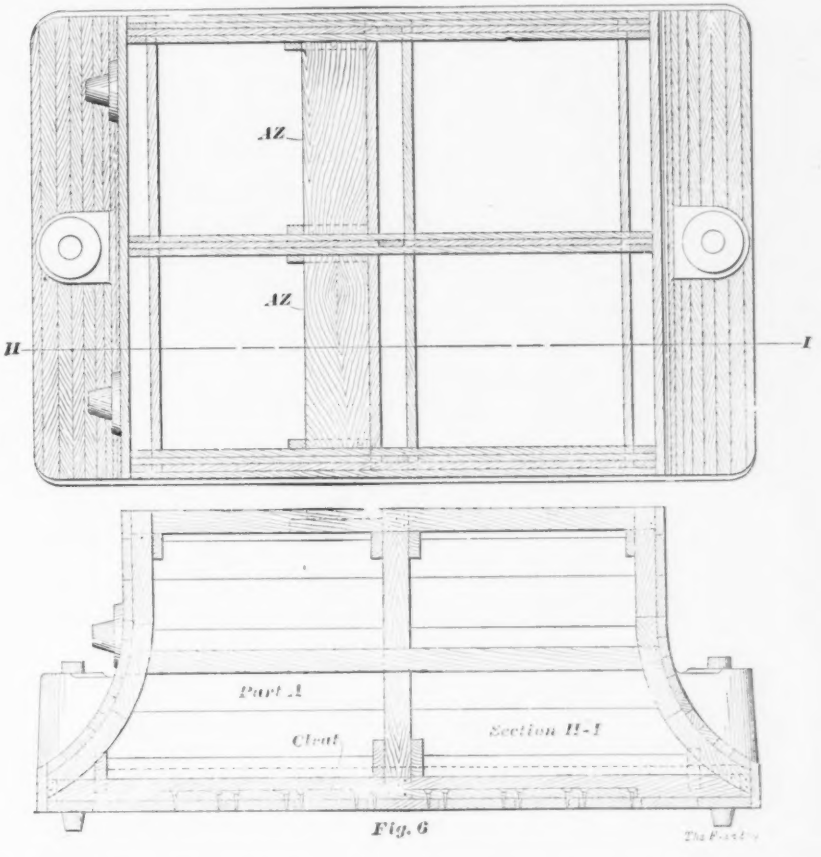


Fig. 6

with which they are enclosed. This frame is then used as a templet to mark off the other two which are sawed to correspond. The three frames are then placed upon a level surface, lined and squared up and secured together in a good substantial manner with bars or braces. The lagging of the sides of the frames is then proceeded with. If the frames are laid off and sawed out accurately the lagging can be gotten out to the exact pattern and down the ends and sides.

Material is gotten out for the bolting down lugs and they are worked out and sawed to conform to the sides of the base, when they are fitted and secured in place. The two relief valve bosses, with their core prints, are also gotten out and secured in place.

It will be found convenient in molding if these latter mentioned parts are attached with screws and loose

dowels inserted from the interior of the pattern, as this manner of securing these loose pieces permits of their withdrawal from the sand during the finishing of the mold.

It will be observed by examining Fig. 3 that the combined diameters of the cylinders and steam chest do not being done to allow of its removal to give access to the interior of the pattern for the removal of screws, loose dowels, etc., during molding. This loose bottom also facilitates the drawing of the pattern, as it affords the molder a good opportunity for rapping the inside of the pattern.

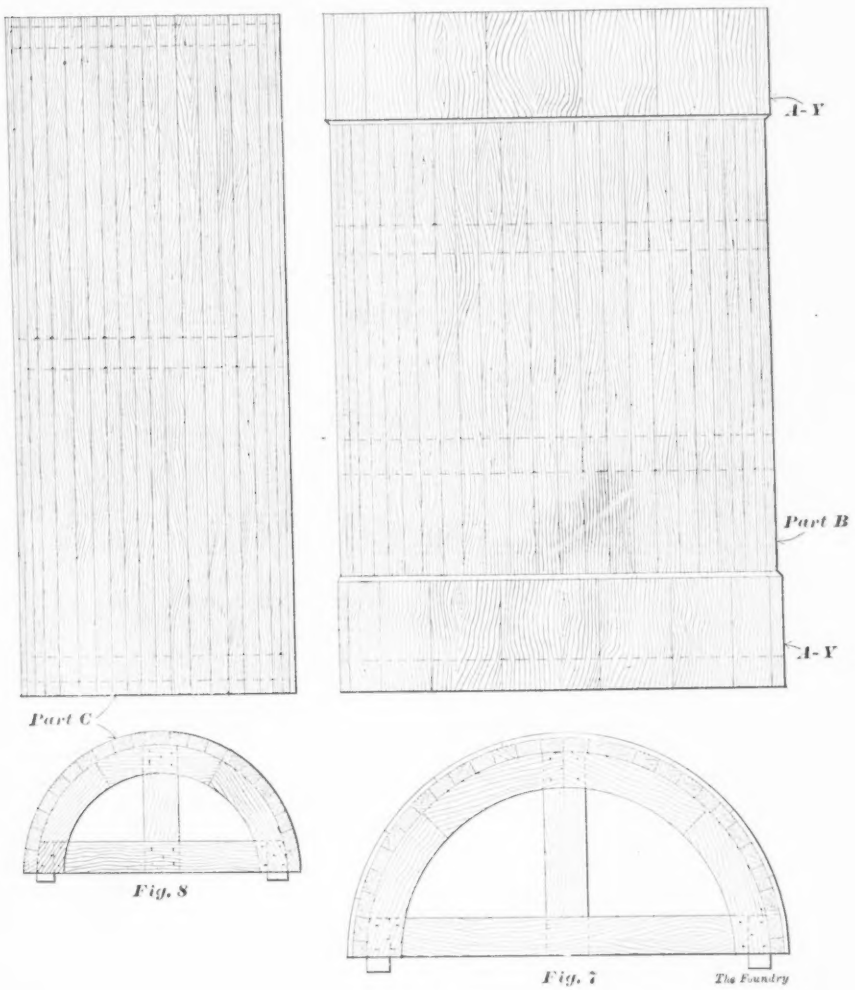


Fig. 8

Fig. 7

The Foundry

enclose the entire parting or top of the base, so that there is a space left between these two parts. For this reason the material A-Z is inserted and secured between the frames as shown in Fig. 6. The pattern is next turned over and the bottom enclosed. It will be observed, however, that a portion of the material used in closing in the bottom is cleated together, this

The bottom having been dressed off and sandpapered, the core outline should be carefully laid out and dotted or painted in. This is often considered unnecessary by patternmakers, but the writer believes the time spent in doing this is invested to good advantage, as it shows the molder the metal distribution, which often determines the point of gating. Another

good reason for drawing in a core outline when no cope core print is used, as in the case under discussion, is that the molder can see at a glance where he must make provision for taking off the vent from cores which must be vented up through the cope.

With the locating and placing of the conical core prints for the bolting down lugs, this part of the pattern is practically completed.

Next one-half of the cylinder B and of the steam chest C, as shown in Figs. 7 and 8, is barreled or lagged up over built up frames as shown. These frames are built up and sawed out to the required outside diameter less the thickness of the lagging. As previously stated, if the lagging is applied in narrow widths, very little dressing will be required to bring it to form.

After the cylindrical part B has been worked up in this manner and dressed off, the material A-Y is applied to the ends to reinforce the counterbore at each end of the cylinder. This material is dressed up and attached as shown. The stock can be gotten out in any convenient width and owing to its being rather thin it will conform to the curve of the cylinder without any difficulty.

In length these two half barrels or half cylinders B and C are equivalent to the length of the line A-X in Fig. 5, or the distance between the end flanges D of the cylinder and steam chest.

After completing these two parts and locating them on the base portion A, we proceed with the part D, as shown in two views, Fig. 9. This

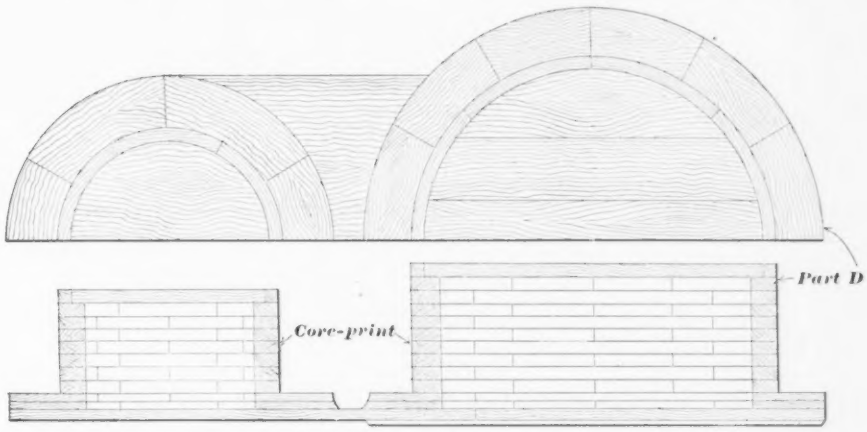


Fig. 9

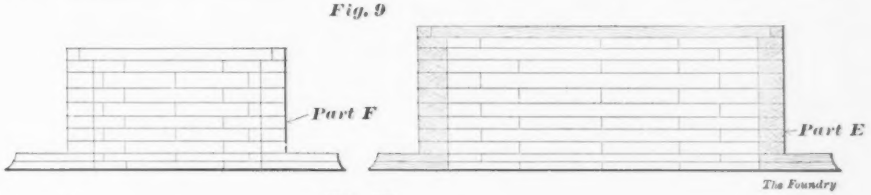


Fig. 10

portion of the pattern forms the two half flanges on the cylinder and steam chest and also serves to secure the two half cylinders B and C together at their ends, as shown in Fig. 5. It will readily be seen that two of these flanges will be required, one right hand and the other left hand, together with their respective core prints. These core prints are built up, turned and attached to the flange D, as shown in Fig. 9.

The parts E and F are shown in Fig. 10 and simply consist of the half facings and core prints which are attached to the base of the pattern A

for completing the flanges and core prints. Two of each of these will be required, one for each end of the cylinder and one for each end of the steam chest.

After having secured parts B and C in their correct position upon the base A and fastened them together with the flanges D, our attention is next turned to the getting out of the steam chest over to the cylinder, it will be found convenient to glue up a solid block and then saw it to form, rather than to attempt any form of built up construction to save material. Having glued up two rectangular blocks of the required dimensions they are laid out and sawed to conform to the diameters of the cylinder and steam chest and fitted

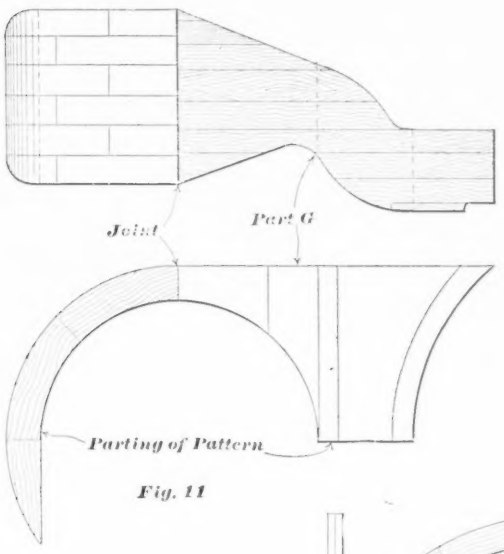


Fig. 11

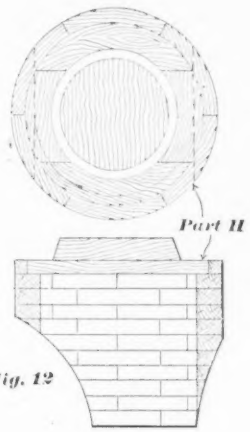


Fig. 12

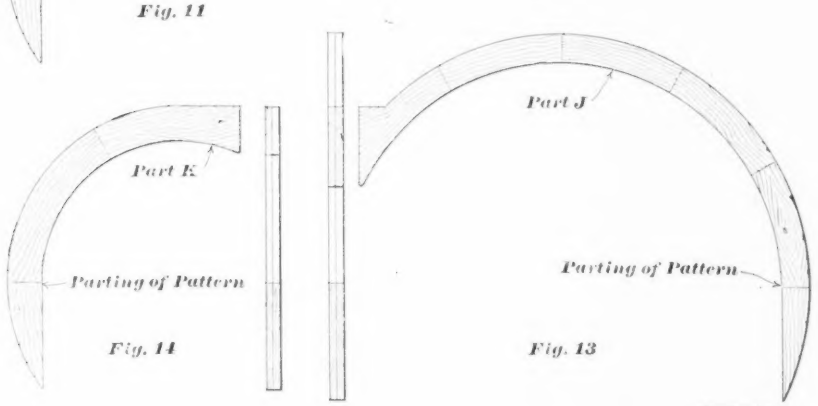


Fig. 14 Fig. 13

The Foundry

ports is shown in Fig. 11, and it is designated as part G of the assembled steam ports. One of these steam pattern, Fig. 5. Two of these parts are required, one right and the other left hand. Each one of these patterns is constructed in three pieces as shown. On account of the irregular form of these steam ports, the largest portion of which extends from the center left of the figure are built up of seg- the two separate parts shown at the down into their correct position. Next, ments fitted around and secured to the steam chest with loose dowels. After the above parts have been worked out in this manner their outline is carefully laid off, the parts removed and sawed and dressed to size,

when they are returned to their position.

The exhaust chamber or part H of the pattern is shown in Fig. 12. This is built and turned up and then sawed so as to fit down in place as shown in Figs. 5 and 12.

structed that it forms one-half of the entire steam chest core, together with the port openings. The core being symmetrical about the center line A-W permits of its being reversed. This core box will form the two half cores required with the use of the change

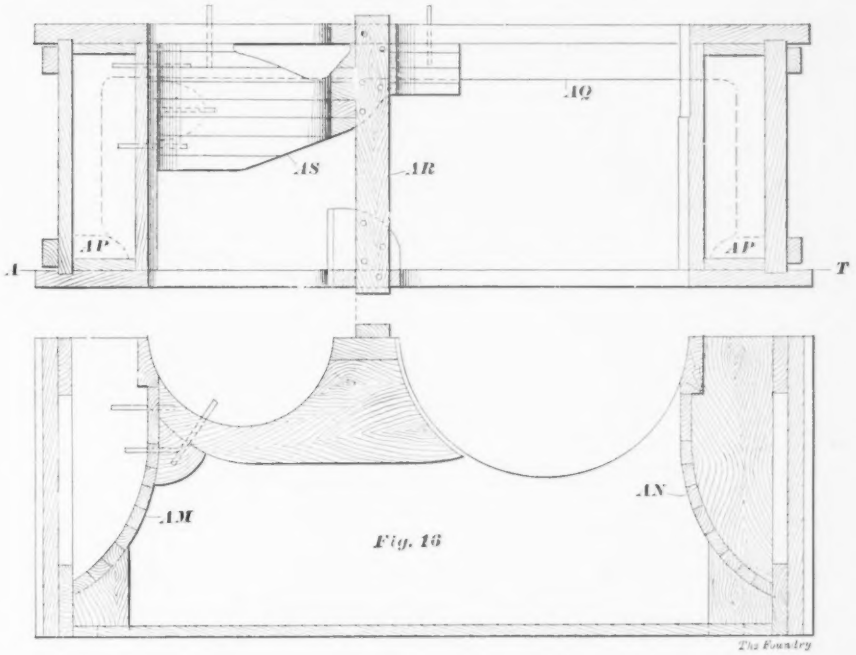


Fig. 16

The Foundry

With the getting out of the two stiffening ribs as shown in Figs. 13 and 14 the pattern is practically completed.

Core Box Construction.

The core box for the steam chest is illustrated in Fig. 15, it being so con-

in outline of the bottom of the port openings, the provision for which will be described later.

By examining the cross section of the cylinder as shown in Fig. 3 it will be observed that the top and bottom outlines of the port do not correspond.

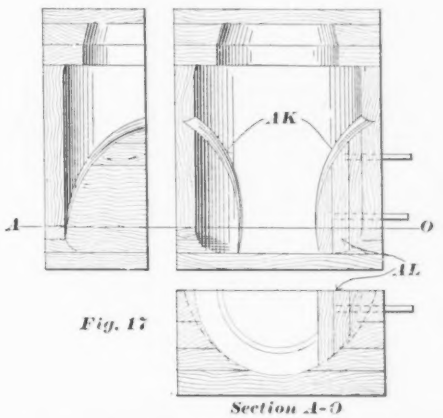


Fig. 17

Section A-O

Fig. 18

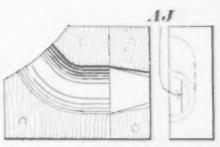


Fig. 19

The Foundry

This necessitates a slight change in the core box at these two points. In Figs. 15A and 15B are shown two cross sections of the core box on the line A-V, with its two sections showing the two different outlines of the port and the loose filling pieces required for altering their form. The upper section A-V shows the core box set up for the upper half of the core as shown in the completed mold, Fig. 20. The lower section A-V is arranged for the lower core as shown in the mold, Fig. 20.

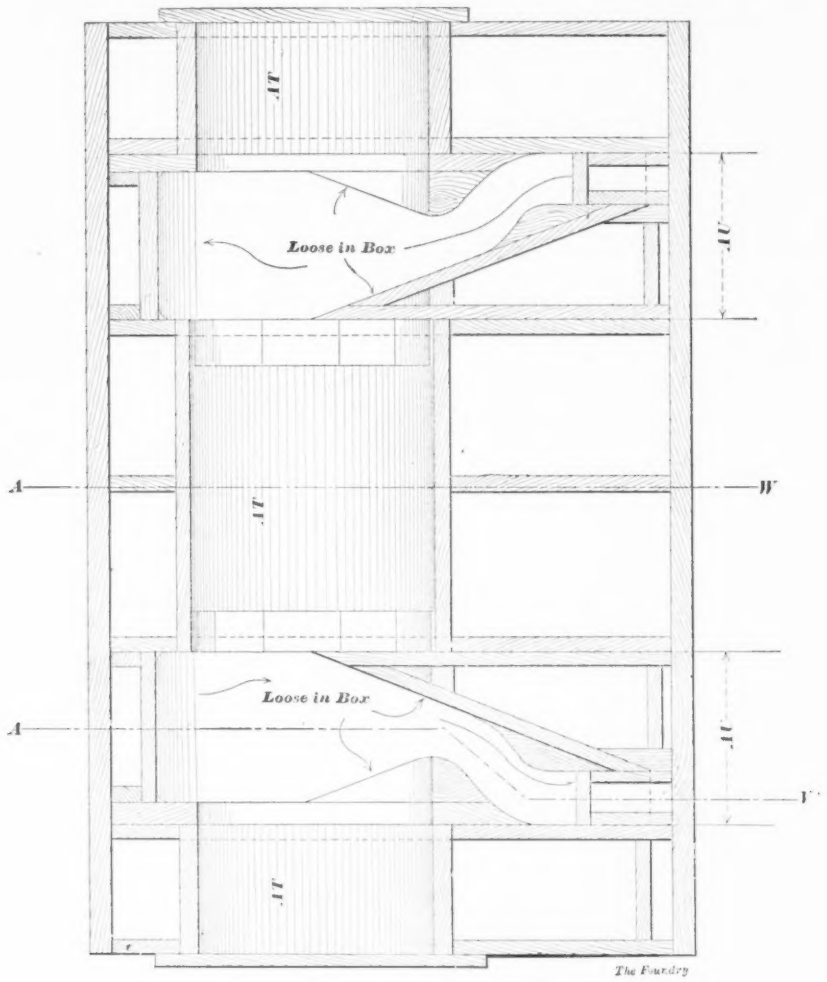


FIG. 15.—A.

In constructing this core box the cross stringers are first gotten out, laid off and sawed to form to receive the lagging A-T. The stringers are next lined up and rigidly secured together by bottom and end cleats or by braces as shown. The lagging is applied and dressed out in the usual manner. The box is then completed by filling in the two spaces A-U with the required loose material somewhat after the manner illustrated. This loose material or series of loose pieces is intended to form the outline of the port openings.

A plan and cross section of the core box used in forming one-half of the core for the base, which also forms the outside of the cylinder and steam chest, is shown in Fig. 16. It will be

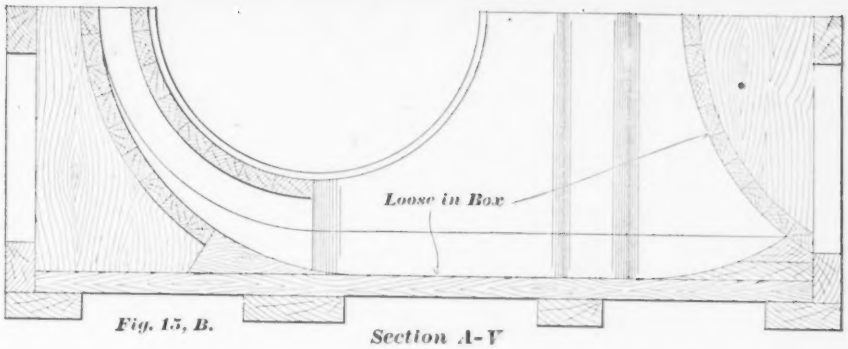


Fig. 15, B. *Section A-V*

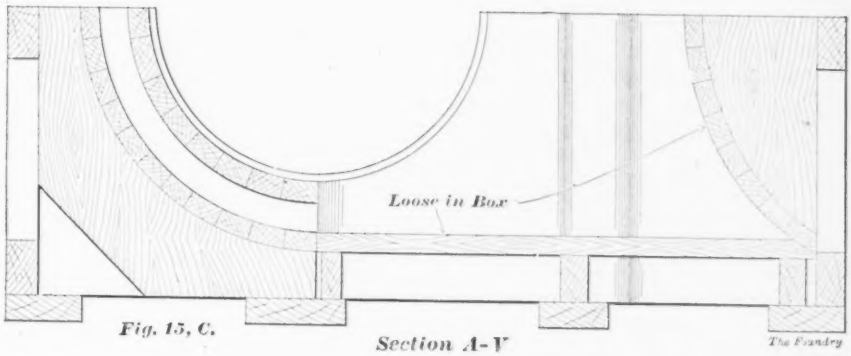


Fig. 15, C. *Section A-V*

observed that by having two pieces, A-S, of opposite hands, that is, right and left, and also two pieces A-R, right and left, together with right and left pieces A-Q and A-P, it is possible to set up our box for either one of the two cores required. The box or frame is constructed rectangular in form, the two sides being cut out to conform to the outer dimensions of the cylinder and steam chest. To provide for the flaring sides of the base the material A-N and A-M is placed in the two

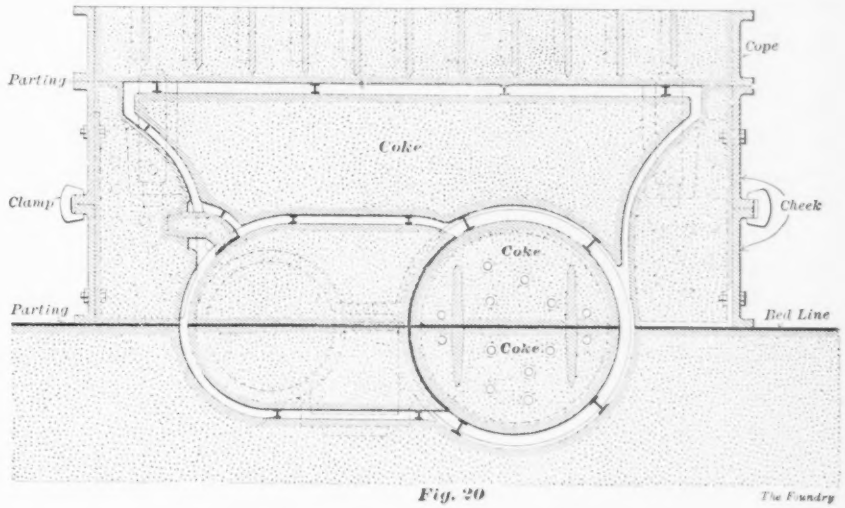


Fig. 20

ends of the box as shown. The box is rammed up in the position shown and the top struck off with the straight edge to conform to the sides of the box. The parts are then withdrawn from about the core and the latter dried upon the plate upon which it was rammed up.

The core box for forming the exhaust chamber core is shown in Fig. 17, two half cores being made from this box. By examining Fig. 3 and the cross section of the completed mold, Fig. 20, the manner in which this core cuts through into the steam chest will be seen. Some special provision is required at this point to take care of the irregular form of the core, and the material A-L is dressed up equivalent to the inner diameter of the steam chest at the point at which the exhaust core cuts through into the steam chest. This material is dropped through into the steam chest and secured with loose dowels as shown. Provision for the rounded corner A-K is made by cutting down into the box as shown. The depression not in use is stopped off or filled up before ramming the core.

The half core box for forming one-half of the holding down bolt core is shown in Fig. 18, while one-half of the core box used for forming the relief valve opening is shown in Fig. 19. To assist in the setting of this latter core in its proper position the core print and core box are flattened off as shown at A-J.

The bore or barrel core for the cylinder is usually made in halves, with the aid of a core frame, or is struck up by the aid of heads secured to the core bar, the parts being subsequently bolted together through the core bar, as is shown in the center core, Fig. 20.

Molding the Pattern.

A cross section of the completed mold on the line D-D-D-D Fig. 1, is shown in Fig. 20. This shows the method of parting the mold very plainly and also the method of setting the cores and the arrangement of the flasks. The mold employed is what is known as a skin dried mold, that is, it is rammed up with green sand, the surface of the mold blackened as would be the case in a dry sand mold, and then the surface dried previous to pouring.

NOTES ON METAL PATTERNS.

By H. N. Tuttle.

These remarks will be confined to that class of metal patterns usually known as cards or gates, and not to patterns

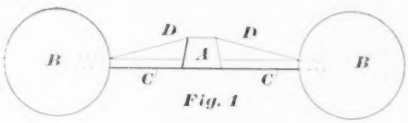


Fig. 1

Fig. 2

Fig. 3 The Foundry

fitted up for machine molding. They are used where a fairly large number of castings are required, yet not enough to warrant fitting up for a molding machine, or in shops not equipped with machines. They are used with a "follow-board" or false cope, and have the advantage over a match plate in that there is no "blind draw" and do not require accurate work in the pattern shop to insure perfect registry of the parts.

As there is quite a difference in regard to the use of terms among molders and patternmakers, it is thought advisable to illustrate them as they will be used in this article. Referring to Fig. 1, which represents the end view of a gate or card, A is the "runner", B is the pattern, C will be called the "gate" and D the wedge. The whole will be called a "card." The "gate" C is usually made of sheet brass, and cast in, unless the pattern be made of iron or brass, in which case it may be part of the casting, if of brass, or it may be dove-tailed, riveted, or soldered in, or may be made of several wires driven into drilled holes. If the pattern be of soft metal or aluminum, the gate is better and cheaper when cast in.

It is nearly always better in case of large carded patterns to make them in aluminum (the weight being about one-third of ordinary pattern metals). Rather large gates of sheet brass, with a hole drilled in one end for anchorage, should be cast in, but should the pattern be so large, or should it be necessary to pour it at so high a temperature as to endanger melting the brass gate, it is better to use sheet phosphor bronze in place of

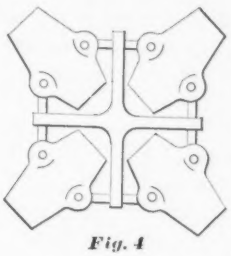


Fig. 4

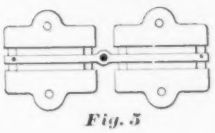


Fig. 3

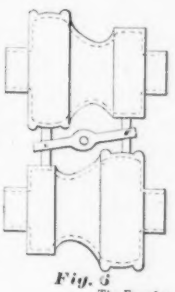


Fig. 5

The Foundry

the brass. This does not seem to fuse when hot aluminum is cast upon it and is also considerably stronger than brass. It is more expensive and in most cases brass is perfectly satisfactory.

The wedges are made either of solder or of cast brass. The better practice is to use brass wedges, as they make a stiffer card, and one that is more easily repaired when the joint breaks. The objection to brass wedges is in the first cost of fitting up, but if done in the following manner, they become as cheap as solder. The wedges are cast in long strips, as in Fig. 2, and after being ground upon the bottom, they are broken apart between the jaws of a vice. They are then placed singly in an aluminum grinding handle (Fig. 3) and the top ground to a feather edge. By doing this in quantities, several hundred wedges may be ground in an afternoon. If left directly from the emery wheel, the wedges would soon tarnish, making trouble in soldering, so they are tinned by first dipping in acid, and then in molten tin, using a large wire ladle for dipping. Care should be taken not to lower the wedges too rapidly into the tin, as the acid upon them would cause an explosion. Pure tin should be used for this, which will strengthen the solder afterwards used for fastening them to the gates and runners. When tinned they will keep forever and be ready for use at a moment's notice.

The greatest care should be given to making the card as strong and stiff as possible, so as to reduce the repair work to a minimum, and also because a stiff pattern draws better than a limber one, especially if there be a deep drag. If the pattern be of such size and shape that it can be economically molded four in a flask, it is generally best to fasten the patterns to a cross gate. Fig. 4 shows a card of caps gated in this way. In case this is not feasible, it is better whenever possible to put two gates in each pattern, instead of one. Two 5/8 inch gates placed some distance apart, as in Fig. 5, are much less liable to break in the soldered joint than with one gate 1¼ inch wide, while the castings are just as easily broken off the runner. In long heavy patterns three, four or more gates are used. As nearly every individual pattern has some characteristic which makes this or that method of carding better for it than any other, no general set of rules could be made. Certain features, however, for strengthening one card of patterns can often be applied to other patterns of a similar nature, and perhaps there is no way of discussing these several features as good as the illustration of actual patterns which have been in continual use for years, and have been found perfectly satisfactory.

As an illustration of the gating of a rather large pattern, Fig. 6 represents a governor pulley, each pattern being 7½ inches long by 6 inches in diameter. The pattern is made of aluminum, and cored out, leaving ¼ inch shell. When the gates were cast in the core was filed out, so as to leave sufficient stock for anchoring the brass. As the patterns were still quite heavy, even when cored, and as it was necessary to gate them as shown, on account of their just filling the desired flask in this position, it was decided advisable to "plate" the joint.

This is illustrated in Fig. 7, P P, being long plates of sheet brass, well soldered to the joint as shown. These plates should have two or more holes drilled in them, for flowing the solder through, as it is almost impossible to make a perfect joint without this provision.

This manner of strengthening the joint has one disadvantage. The soldered joints shown at R are so much stronger than ordinary, that the gate is

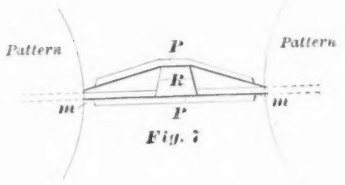


Fig. 7

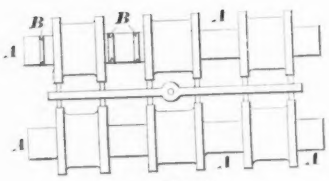


Fig. 8

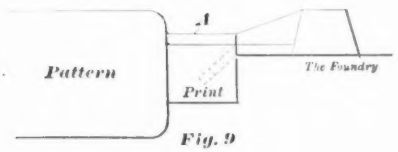


Fig. 9

liable to be broken at point M, with continual hard usage, especially if an ill-fitting "followboard" be used. When it is decided to plate the joint, an extra strong, stiff gate should be used, preferably one of phosphor-bronze. The pattern illustrated has been in use for several years and has not yet been into the pattern shop for repairs.

Often in coring out heavy patterns, the core which is to be made for the regular castings may be used. This will save making a new box, while the prints on the patterns may be made by driving wooden plugs into the cored holes, which may be fastened by means of wood-screws or pins.

Patterns of spools, and in fact most patterns of castings which have a horizontal hole cast axially through them, may be carded in a very strong manner, and incidentally lightened, by coring them with the standard core, and stringing them upon round hardwood rods, these rods forming the core-prints. In Fig. 8 A represents the hardwood rods, all the visible part of the rods answering for core-prints. Small V shaped grooves cut around the prints, near the patterns, as shown at B B B, will leave beads of sand in the mold, which will prevent the iron running by, should the core be a little loose.

It will sometimes be found that by far the best place to locate the gate for strength and balance is right in a core-print. In such a case the gate may be cast in, as shown in Fig. 9, casting also lug A on the top of the print, to carry the metal over the core. Or, if it be more feasible, a gate may be fastened in the corebox, in which case the core must be placed into the mold in the same position each time.

Patterns which are very heavy, or have a deep "draw", or for any reason are subject to unusually hard usage, may have one wide gate put in in a vertical position. This stiffens the card in an up and down direction, and greatly lessens the liability of the gate to break off where it joins the pattern. This disagreeable break is usually caused by the continual driving of the draw plug into the runner, or by an improperly fitted "follow-board", or one in which the loose sand has been carelessly allowed to collect.

While it is a comparatively simple matter to melt a new gate into a soft metal pattern, it is considerably more of a chore to fix this break in an aluminum pattern. There are at least two good ways of doing this, the first being advisable in some cases and the second in others. The first way has been previously mentioned,—that of driving brass wires into a straight row of holes,—and requires no comment except that the holes should be drilled in different directions, and the wires afterwards bent to a parallel plane. This gives a dovetail action,

and prevents the gate coming out, even should it get loose.

The second way is that of "casting" in a new gate. The pattern should be rammed up and a seat made in the parting in the proper place for the new gate. The pattern is now drawn, the old gate sawed out, the sawed surfaces tinned, and the pattern returned to the mold. After setting in the new gate, the mold is closed, and aluminum solder poured in at a high temperature, so as to fuse on the tinned surfaces.

Another case which is quite common is that of a pattern of such size and shape that all of the pieces cannot be fastened directly in the runner, and still be placed in an economical position for molding. Fig. 10 shows an example of this kind. The patterns are of such size that the card as shown nicely fills the flask, and if gated in any other way would make a more disagreeable parting. The gate is curved to conform to the shape of the pattern, as shown at A. It will be noticed that the gates are placed at an angle. This incidentally stiffens the pattern. The center patterns require four gates each, and these are bent so as to lap by each other, and thus make a strong joint. Another similar case is shown in Fig. 11. In this card the runner is extended beyond the ends of the patterns, and to either end of this runner is soldered a light brass steady runner (A A). A piece of thin brass is cast in either end of each pattern, which is soldered to the steady runner. In this way the whole card is well bound together, while the brass at the ends of the patterns is so thin as to leave no appreciable mark on the castings. Fig. 12 shows a pattern of such size that only two will go into a flask and so heavy as to require strong gating. This runner is made from a cross runner, with one arm cut off. Fig. 13 shows a card with a special runner because a hole near the end of the pattern rendered it impossible to gate directly into the end. Fig. 14 shows a runner often used in carding pulley patterns. Fig. 15 shows an H runner, the gate at either end holding the weight of the pattern, while the gate at the side, or at the center of the runner, acts as a steady gate.

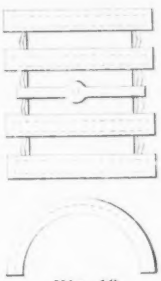


Fig. 10

Fig. 10-A

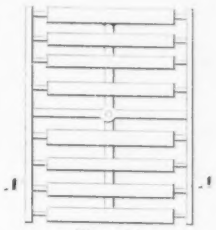


Fig. 11

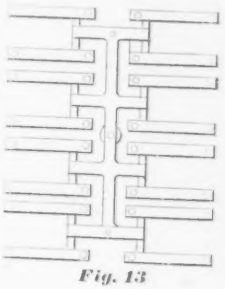


Fig. 13

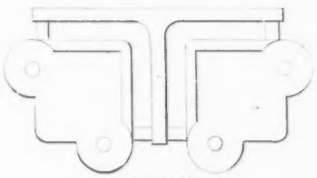


Fig. 12

Fig. 14

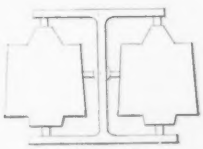


Fig. 15

The Foundry

Whenever a special runner is necessary, it is advisable to make a pattern and have one cast, rather than to improvise one by bending and soldering, as such a runner is liable to give out when the pattern is most needed.

Worm-wheels cannot be carded on account of their drawing with a twist. Because of their being wrapped and drawn separately, the cope core-print

TABLE FOR FIGURING GEAR TEETH.

For finding the radius of a wheel when the pitch is given, or the pitch of a wheel when the radius is given, that shall contain from 10 to 250 teeth, and any pitch required.

Rule:—Multiply X in the table by the pitch given, and the product will be the radius of the wheel required.

Or divide the radius of the wheel by X in the table, and the quotient will be the pitch of the wheel required.

No. of Teeth	X	No. of Teeth	X	No. of Teeth	X	No. of Teeth	X	No. of	X
10	1.618	58	9.235	106	16.873	154	24.511	203	32.305
11	1.775	59	9.395	107	17.032	155	24.670	204	32.464
12	1.932	60	9.554	108	17.191	156	24.830	205	32.623
13	2.039	61	9.713	109	17.350	157	24.989	206	32.782
14	2.247	62	9.872	110	17.509	158	25.148	207	32.941
15	2.425	63	10.031	111	17.668	159	25.307	208	33.100
16	2.517	64	10.190	112	17.827	160	25.466	209	33.259
17	2.721	65	10.340	113	17.987	161	25.625	210	33.419
18	2.819	66	10.508	114	18.146	162	25.784	211	33.578
19	3.018	67	10.667	115	18.305	163	25.944	212	33.737
20	3.167	68	10.826	116	18.464	164	26.103	213	33.896
21	3.355	69	10.985	117	18.623	165	26.262	214	34.056
22	3.513	70	11.144	118	18.782	166	26.421	215	34.215
23	3.672	71	11.303	119	18.941	167	26.380	216	34.374
24	3.831	72	11.463	120	19.101	168	26.739	217	34.533
25	3.989	73	11.622	121	19.260	169	26.899	218	34.692
26	4.148	74	11.781	122	19.419	170	27.058	219	34.851
27	4.307	75	11.940	123	19.578	171	27.217	220	35.000
28	4.466	76	12.099	124	19.737	172	27.376	221	35.169
29	4.625	77	12.258	125	19.896	173	27.535	222	35.328
30	4.783	78	12.417	126	20.055	174	27.694	223	35.487
						175	27.853		
31	4.942	79	12.576	127	20.214	176	28.013	224	35.646
32	5.101	80	12.735	128	20.374	177	28.172	225	35.805
33	5.260	81	12.899	129	20.533	178	28.331	226	35.965
34	5.419	82	13.051	130	20.692	179	28.480	227	36.124
35	5.578	83	13.210	131	20.851	180	28.639	228	36.284
36	5.737	84	13.370	132	21.010	181	28.798	229	36.443
37	5.996	85	13.591	133	21.169	182	28.967	230	36.592
38	6.155	86	13.691	134	21.328	183	29.127	231	36.751
39	6.214	87	13.849	135	21.488	184	29.282	232	36.910
40	6.373	88	14.008	136	21.647	185	29.441	233	37.079
41	6.532	89	14.168	137	21.806	186	29.600	234	37.238
42	6.691	90	14.327	138	21.965	187	29.759	235	37.398
43	6.850	91	14.486	139	22.124	188	29.918	236	37.557
44	7.009	92	14.645	140	22.283	189	30.077	237	37.716
45	7.168	93	14.804	141	22.442	190	30.237	238	37.875
46	7.327	94	14.963	142	22.602	191	30.336	239	38.034
47	7.486	95	15.122	143	22.761	192	30.555	240	38.193
48	7.645	96	15.281	144	22.920	193	30.704	241	38.352
49	7.804	97	15.440	145	23.078	194	30.873	242	38.512
50	7.963	98	15.600	146	23.238	195	31.032	243	38.671
51	8.122	99	15.739	147	23.397	196	31.191	244	38.830
52	8.281	100	15.918	148	23.556	197	31.350	245	38.989
53	8.340	101	16.077	149	23.716	198	31.510	246	39.148
54	8.509	102	16.236	150	23.875	199	31.669	247	39.307
55	8.758	103	16.395	151	24.034	200	31.828	248	39.467
56	8.917	104	16.554	152	24.193	201	31.987	249	39.636
57	9.076	105	16.713	153	24.352	202	32.146	250	39.785

gets pretty hard service, so it is generally advisable to make the prints entirely of steel. Both cope and drag print should be made of the one piece of steel (Fig. 16), and cut away in the center so as not to strain the casting. It will be noticed that the full size of the print runs into the casting about ⅛ inch (A A, Fig. 16), so as not to leave a crack under the prints when the pattern shrinks from casting. The cope print should be drilled and tapped.

When a single pattern is made of soft metal or aluminum, it will be found that the rap hole lasts but a short time, due, of course, to the softness of the metal. One easy way of providing for this is to cast in a steel rap plate. This plate should be beveled on the edges so as to dovetail itself into the metal, and if large should also have anchor holes drilled in it. The plate should be kept as small as consistent with good service, on account of the straining. The following case will give some idea of how large a plate may be safely cast in. In

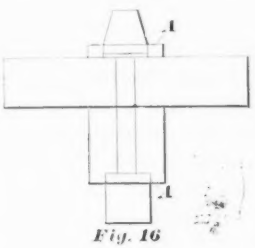


Fig. 16

left projecting above the surface of the gear about 3-16 inch, so as to form a tenon for centering the hub.

Several of these patterns, ranging from 12-inch diameter and 6-inch face, down to half this size, have given perfect satisfaction.

The pattern should be cored out as shown, leaving the thickness of metal at A slightly less than the thickness of the tooth. This gives an even thickness of metal all around, and prevents sagging in the cope. The drag print B is turned with a tenon and driven into the cored hole, which should be bored out. These patterns are especially useful in a steel foundry.

TABLE FOR FIGURING GEAR TEETH.

The accompanying table has been sent to us by Mr. H. McVeen, who states that it is a table which he has found very useful indeed in his own work both in the drying room and in the pattern shop

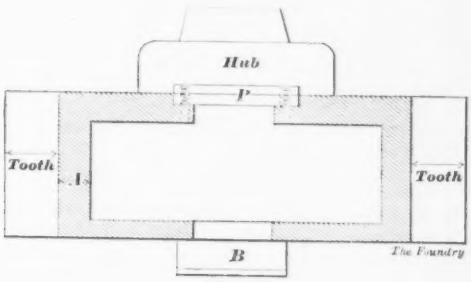


Fig. 17

each of two aluminum patterns (right and left) about 12 inches in diameter by 4 inches deep was cast a steel plate 2″ x 4″ x ½″. One casting came out perfect, while the other showed a slight crack, running a short distance from one corner of the plate. This has caused no trouble, and has been in use about four years.

When making aluminum gear patterns the plate may be made of cast iron or steel, turned, and fastened in a recess, also turned, as shown (P, Fig. 17). The plate is held by ⅜ inch machine screws, tapped through both pattern and plate. If there be a cope hub, the plate may be

and he has never seen it in print. He feels that it would be of interest to other readers of THE FOUNDRY and hence has forwarded it to us. There has evidently been a great deal of work spent on the table, and it is one which should certainly be of interest to patternmakers.

Frank H. Buhl, Joseph Riddell and Morris Bachman have applied for a charter for the Sharon Pattern Works, of Sharon, Pa. They will make patterns for iron, steel and brass foundries and will have their works in the Budd field next to the Damascus Brake Beam Co.

CONVERTER STEEL CASTINGS PRACTICE.—NUMBER 2.

By Arthur Simonson.

In attempting to give a detailed description of the operation of a Tropenas plant, it is realized that no amount of written or spoken matter will enable a person not thoroughly acquainted with steel making in general, to produce any kind of castings, to say nothing of the high-grade work that is called for today. The only way to learn how to operate a converter plant is to spend a long time in company with one who has had considerable experience and is perfectly familiar with the reactions that take place. It is true that when the converter was first introduced the pioneers had no one to instruct them, but it would be much too costly for all to learn by the same means. It is true, indeed, that after being under personal instruction and seeing a great many blows made, conditions may arise after the operator is left to himself which may get the better of him, and cause him to forget some of the principles that have been drilled into him. It is only by the strictest attention to details that success is achieved, but this is true of all businesses, not only steel making. An unsuccessful foundry business resembles a Kansas cyclone in its certainty of disaster—quick and complete. A foundry that is not watched at every point can absorb money as fast as a Rockefeller can pour it in, as many a poor man has discovered. The essentials to success are shrewdness, watchfulness and science.

Lining of Converter. — There are two or three ways to line the converter, and they are all equally good, the factors determining the use of any one being convenience and local conditions. It may be lined with special blocks, which while expensive, make the time occupied in repairs much less, this being often a very serious matter when the converter needs repairing and orders are waiting fulfillment. The chief drawback to the use of special blocks is that in making repairs a large amount of good brick has often to be cut away to make room for the new ones. A sand lining rammed in to shape may be used and is probably as good and cheap as any provided the proper grade of material is available. The third way is to use the ordinary shapes of furnace brick. This is probably the most common way and will be described in full detail as it probably calls for more explanation than the others. Whatever material is used it is necessary that it should be as refractory as possible, and nothing should be used in the way of brick that has been burnt

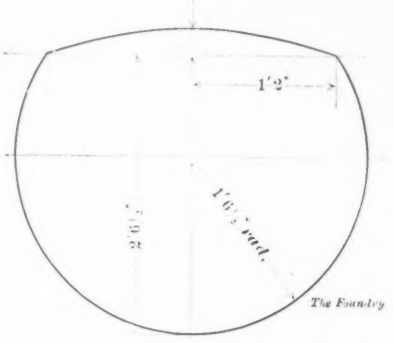


Fig. 1

at a lower temperature than is necessary to turn over a 3,500-degree Seger cone. This means about 95 per cent silica and almost perfect freedom from lime and magnesia. In the case of ganister mixture, the very best quality of silica clay must be used and in order to cause it to set very hard, it may be mixed with weak lime water instead of ordinary water.

Procedure for Lining the Converter with Ordinary Forms of Silica Brick.— The bricks used are the square 9 x 4½ x 2½-inch, with the arch 9 x 4½ x 2½ x 1½-inch, the wedge, 9 x 4½ x 2½ x 1½-inch, and a special wedge used in the mouth 9 x 4½ x 2½ x 1-inch. A small quantity of split brick is also needed, this is a rectangular brick one-half the thickness of the ordinary square.

Two or three rough wooden forms should be prepared having dimensions as shown in the sketch Fig. 1. They are made by sawing out boards for top and bottom, two inches less in dimensions each way, and then nailing one-inch strips on the edges. The forms are

eighteen inches high. Set the converter in a vertical position by means of a plumb line, and then commence the lining operations by laying ordinary firebrick in the circular bottom until a level of about twenty-six inches below the center of the lower tuyere slot in bottom wind box is reached. Break all joints and set alternate courses at right angles. Use ordinary firebrick of good quality for this part of the operations, as they are less friable than the silica brick, and do not come into direct contact with the heat. The cement used may be made of one-half each high-grade silica clay and crushed silica rock. For grouting in the courses after laying this cement may be thinned down with water.

The next step is to set one of the forms. The illustration, Fig. 2, shows the location of this. It will be seen that the circular part of the form is concentric with the circular shell of the converter, and the part of larger radius which gives the conformation of the face of the tuyeres is set so that a line joining the ends of the arc is parallel to the center line of the trunnions. A course of arch brick on end is laid round the form, and outside of this a row of ordinary firebrick backing and the remaining space between brick and shell is rammed in with ganister. This procedure is continued until a level two and a half inches below the center of the slot in the shell referred to above is reached. This brings us to the most important point in the lining, namely the setting of the tuyeres. Upon this depends a great deal of the assurance of success in the subsequent manufacture of the steel. The tuyeres both individually and as a whole, must be set absolutely level both in a direction parallel to their length and also in a direction at right angles to this. In other words, the tuyeres must all be in exactly the same plane. The illustration shows the tuyeres grouped together and it will be noticed that for convenience they are numbered No. 0 in the center, No. 1 for the first tuyere on each side, then No. 2 and No. 3 respectively, outside this. The higher numbers diverge more from the center than the lower numbers, and the whole system is symmetrical. These tuyeres are made of the very highest grade of silica material available, and burnt at a very high temperature as they are subjected to the greatest amount of wear and tear and the greatest amount of chemical action. In setting the tuyeres it must be borne in mind that it is the holes that must be leveled up and not the outside of the bricks, as the outside may be warped to some extent.

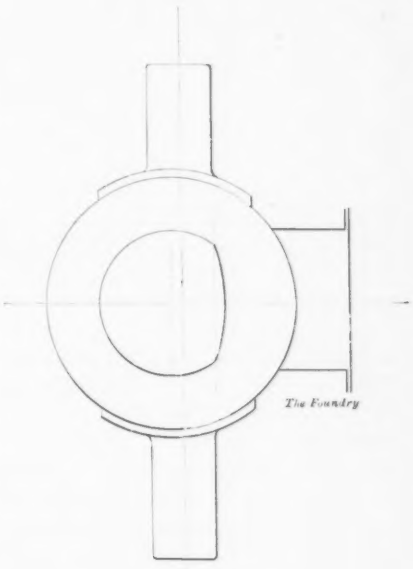


Fig. 2

Round iron bars of smaller diameter than the tuyeres should be inserted in the holes and the leveling done on the protruding ends of these, this being the only way that accuracy can be insured. Together with this leveling it should be ascertained that the tuyeres come opposite the slot in the shell communicating with the lower wind box, to allow of an unrestricted passage of the air into the converter and the possibility of cleaning out any slag or iron that may inadvertently get into the tuyeres. After being satisfied that the lower tuyeres are correctly set in every particular, the upper tuyeres are set directly on top of them. The upper wind box has a slot corresponding with the lower one, and the rectangular openings in these tuyeres

should be in line with it. It is not necessary to use the same care in setting these tuyeres, as they are merely combustion tuyeres and do not at any time approach the surface of the iron. They are numbered similarly and have the same conformation as the lower tuyeres. The body of the converter is then lined up to a point about two feet below the top of the cylindrical part of the shell, at which point the wooden forms may be dispensed with. Be sure to leave no

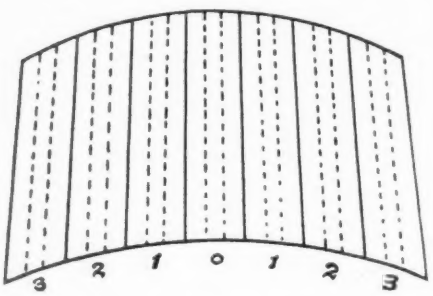


FIG. 3.—TUYERE BLOCK.

open spaces between the bricks and grout all the joints well with thin grout. From this point a certain amount of mechanical skill is needed in setting the brick as it is largely a matter of hand and eye. It is not an easy matter to describe, nor is it an easy matter to accomplish, but the principle is to overlap each course from this point up the cone until the lining terminates at the mouth of the converter in a circular opening fifteen inches in diameter. The last two rows in the mouth may be made with the special wedge brick mentioned. After the lining is completed the wooden forms may be burnt out. The bottom is then built up with pure silica brick until a depth of from sixteen to seventeen inches below the bottom edge of the tuyeres is reached. This corresponds very closely to a capacity of two tons. The lining being now complete, a wood fire is started, the blast valve being shut off and all covers off the wind boxes. If the blast valve from the blower is left open, it may happen that gas will accumulate in the pipe and cause an explosion which may be more or less serious. In describing the lining of the converter nothing has been said of the manhole door in front of the converter, which some operators use all the time and and others have discarded. It is most useful in making repairs, enabling the converter to be cooled off very rapidly and also forms a convenient way of handing in to the bricklayer his supplies of bricks and cement. When this is used an arch should be built around the opening in the shell and filled in afterwards, then when the manhole is punched out the remainder of the lining is undisturbed.

Life of Lining. — It is almost impossible to give definite figures in relation to the life of furnace linings. So much depends on shop practice and quality of materials that it is impossible to make an accurate estimate. For instance, if a furnace is run every other day and repaired every other day, it will last longer than if run daily for the same number of blows. There is a limit to the amount of patching that can be done, and if it is done before too late it will not be necessary to cut away a lot of good brick in order to make extensive repairs. The inner row of brick, that is the silica part of the lining, should never be allowed to be entirely penetrated. By making repairs at as short intervals as possible and preserving the original lines of the furnace, the life of linings will be preserved indefinitely, and the blows will be much more regular and uniform. The parts that are most subject to corrosion are the regions immediately surrounding the tuyeres, and at the base of the upper cone where the metal lies when the converter is in the pouring position. When repairing the tuyeres, bars slightly less in diameter than the holes should be inserted and ganister rammed around them and allowed to dry with the bars in situ. By careful attention to repairs as many as 150 and even 200 blows can be gotten out of the converter before it is necessary to renew the tuyeres, and up to one thousand blows before it is necessary to entirely reline. A new set of tuyeres can be inserted in about three hours. A considerable amount of the depreciation of the lining is caused by crushing and spalling. Silica brick has

a very high coefficient of expansion and the alternate heating and cooling of the lining causes it to crush at one time and spall off at another. The expansion is so great that the bolts holding down the upper cone sometimes pull apart, the heads flying several yards. After a converter has been newly lined these bolts should be loosened to allow the expansion to take place.

Melting Stock. — The metal that is put into the converter to be converted into steel must be of a definite composition within certain limits. Before going into the converter it has to be melted in a cupola, where certain losses take place. These losses have to be taken into consideration when figuring the charges. In specifications for steel castings a limit is generally set for the content of sulphur and phosphorus, and as in no acid furnace can this percentage be reduced it is necessary to provide raw material sufficiently low in these elements to meet the specifications. In this respect it is exactly the same as the open-hearth practice. The analysis of the metal before blowing must be:

Silicon	1.80 - 2.10 per cent.
Manganese	0.60 - 1.00 per cent.
Sulphur, Phosphorus.	low as possible.
Carbon	about 3 per cent.

The cupola charges are made up of pig iron and steel scrap. The steel scrap is generally the heads and runners, scrap and defective castings from previous heats. Outside scrap is so uncertain in its composition that it is unsafe to use it. As a rule the best way is to arrange to melt in the cupola just the amount of scrap made in average daily practice. If a surplus accumulates the percentage can be temporarily increased, and if a deficit occurs the amount can be cut down. Ordinarily with a satisfactory operation of the plant, about twenty to twenty-five per cent of steel scrap can in this way be carried in the cupola charges. The flux used in the cupola consists of limestone or oyster shells, and the coke is seventy-two-hour coke with sulphur 0.75 per cent or thereabouts.

Calculation of Cupola Charge. — There are two ways in which this may be done, a graphic way and an arithmetical way. In figuring out the charge the two elements which are closely controlled are the silicon and manganese, and particularly the silicon. This element is always figured first. As regards sulphur and phosphorus it is understood that they are as low as possible in the raw materials so that after that point has been settled, they may be neglected. Carbon, that is, total carbon, is practically the same in all grades of pig iron used and may be neglected on that account, as it will be practically uniform anyway. The relation of the combined carbon to the graphitic does not make any difference, as after the first few minutes' blowing it will all be in the combined state.

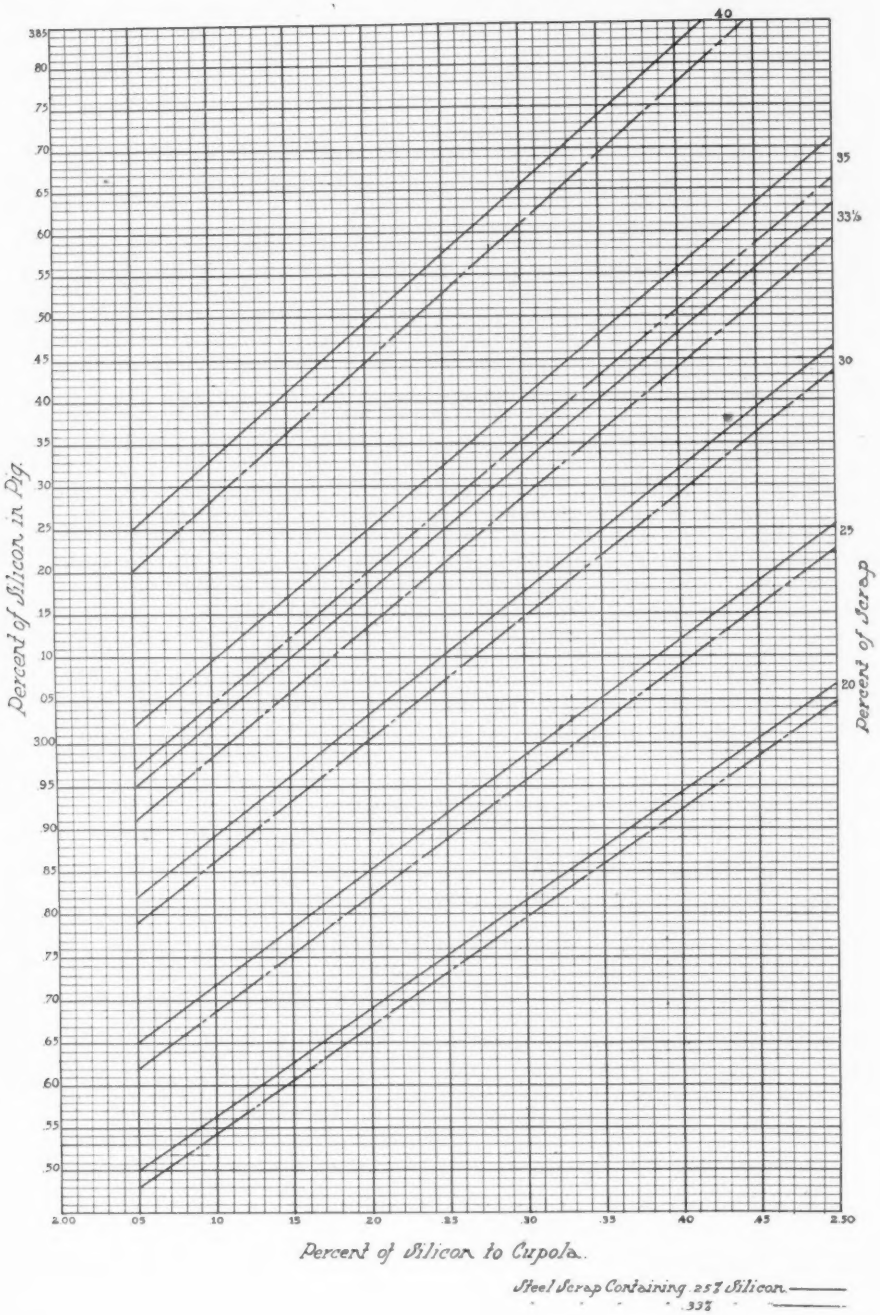
The first thing to be decided is the amount of scrap it is proposed to carry in the charge. Of course there are cases where the grade of pig iron available will place a limit on the amount of scrap that may be used. If the pig iron is all high silicon, it will be imperative to use a high percentage of scrap to cut down the silicon to the required amount. If the pig iron is low in silicon, it may be possible to use only a very small proportion of scrap. But for the purposes of this article we will suppose that the conditions are ideal, that we have the correct kinds of pig iron and are able to carry any reasonable amount of scrap. As stated above, it is wise, all things being equal, to confine oneself to the scrap made in one's own plant, and in an ordinary way this will amount to say, from twenty to twenty-five per cent. Let us assume that we have two brands of iron analyzing:

	No. 1.	No. 2.
Silicon	3.50	2.00
Manganese	0.25	1.50

Let us assume that our steel scrap averages silicon 0.25 per cent, manganese 0.75 per cent.

Let us also assume that we will carry twenty-five per cent of scrap.

Problem. — In a 100-pound charge, what quantities of the above No. 1 and No. 2 pig irons and steel scrap will give a mixture with an analysis of say, silicon 2.00 per cent, and manganese 0.80 per cent? We know how much steel



scrap we are going to carry and will figure the silicon first.

(Weight of scrap × per cent silicon) + (weight of pig iron × per cent silicon) = (1,000 pounds mixture × 2.00 per cent silicon)

$$(250 \times 0.25) + (750 \times X) = 2000$$
$$62.5 + 750X = 2000$$
$$750X = 2000$$
$$X = 2.5833$$

The next question is: In a charge of 750 pounds, how much pig iron No. 1

at 3.50 per cent silicon, and how much pig iron No. 2 at 2.00 per cent silicon, will give a mixture containing 2.5833 per cent silicon?

Let X equal the weight of pig iron No. 1 containing 3.50 silicon, then (750 — X) represents the weight of pig iron No. 2 containing 2.00 silicon, and (X × 3.50) + (750 — X) 2.00 = (750 × 2.5833)

$$3.50\ X + 1500 - 2X = 1937.5$$
$$X = 291.6$$

The quantity of No. 1 pig iron required is therefore accurately 291.6 pounds, and of No. 2 is 458.4 pounds.

In round figures the amounts of our cupola charge of 1,000 pounds would therefore be:

No. 1 pig iron ..... 290 pounds.
No. 2 pig iron ..... 460 pounds.
Steel scrap ..... 250 pounds.

Let us check this over to see if it is correct:

(290 × 3.5) + (460 × 2.00) + (250 × 0.25) = (1000 × 2.00)
1015 + 920 + 62.5 = 1997.5

This figures out as closely as it is possible to weigh pig iron. The above calculations cover the silicon only, and while they seem bulky they have been put down in detail to make it perfectly plain. As a matter of fact the calculations are made in a very few minutes. We must now see these weights will result in content of manganese.

(290 pounds No. 1 × 0.25 manganese) + (460 pounds No. 2 × 1.50 mang.) + (250 pounds steel scrap × 0.75 manganese) = (1000 pounds total charge × X per cent manganese), that is:

$$72.5 + 690 + 187.5 = 1000\ X$$
$$X = 0.95 \text{ per cent.}$$

Allowing for the loss of manganese that takes place in melting in a cupola, this 0.95 per cent will probably be a shade under 0.80 when melted. The above mixture is therefore satisfactory and will give correct results. There will be a slight loss of silicon in the cupola, but the result will be well within the working limits. The above calculations can be worked out for any grades of pig iron by substituting percentages.

The Graphic Method. — This method has been figured out on the above lines and reduced to a diagram. For the diagram reproduced here the writer is indebted to A. H. Jameson. It is figured for two grades of steel scrap, one containing 0.25 per cent of silicon and represented by the full line, and one containing 0.33 per cent of silicon and represented by the broken line.

The diagram may be used in a variety of ways. For instance, it may be used to give the amount of steel scrap that a certain pig iron will carry to give a desired per cent of silicon in the cupola. Knowing the per cent of silicon desired in the cupola, and the amount of scrap that is available, it will give the per cent of silicon the pig iron must contain. Given the per cent of silicon in the pig iron and the amount of scrap to be carried it will give the resulting silicon in the cupola.

The Wood Shovel & Tool Co., of Piqua, O., has issued a very neat catalog, 8 x 10 inches, containing a reprint of a description of its works which is illustrated with very fine half tones printed in sepia ink. It also contains a short statement concerning the advantages of the Wood shovels and illustrations of the same, one being the new pattern, flat back molder's shovel. The publication is entitled "The Model Shovel Plant of the World."

The Manufacturing Equipment and Engineering Co., 209 Washington St., Boston, Mass., has issued a small catalog 3½ x 6¼ inches describing and illustrating sanitary wash bowls, soda kettles, shop stools, benches, lockers, and storage racks manufactured by this company.

Geo. G. Blackwell, Sons & Co., Ltd., Liverpool, England, are sending out catalogs describing the Blackwell cupola flux, known as Bohemian flux, also a folder entitled "Two Valuable Foundry Necessaries" which contains articles by A. E. Outerbridge on ferrosilicon and by F. S. Grinder on fluorspar as a flux.

METALS IN FOUNDRY PRACTICE

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Malleable Iron and Steel.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

We have also made arrangements with several others to act as special contributors. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

TREATMENT OF CUPOLA CINDER.

Question.—How do you recover the iron from the dump from your cupola? What kind of a cinder mill do you use?

Answer.—I consider this question of enough importance to be answered in "Cast Iron Notes," although I have described the method many times.

The ordinary cinder mill drops all small pieces of iron through the openings and they are thrown away with the ground slag.

The water mill saves the fine particles along with the larger pieces. The large apparent recovery of iron is partly due to a considerable quantity of marbles of black slag which are weighed as iron. The water mill is a success and a paying investment.

The repairing of all cinder mills is a considerable item of expense, and the cost of attendance is larger.

The most inexpensive and convenient method is the one that I have used for a great many years and it requires no apparatus. When the last iron has been drained from the cupola and just before the bottom is dropped with sand from the gangway, build a low dam, say four feet diameter, under the end of the cupola spout. Let a man hold an iron rod across the spout and let the rest of the cupola force with a piece of old shafting, say 2 inches diameter and eight feet long, used endwise as a ram force in the breast. Shove it clear to the center of the cupola bottom and draw it back and forth once or twice to make a clear channel and allow all the slag to run out on the floor, after which the bottom is dropped as usual. In the morning there being no slag in the dump the pieces of sand bottom can be removed and thrown away. All pieces of coke and iron, large enough to handle, are picked out to use again while all of the remaining coke, slag and iron are shoveled up and taken to the cupola scaffold.

After the last charge of iron is in the cupola this material is all thrown on and helps to hold down the blast. The small coke makes the last iron as hot as any other. All slag and iron is melted without the loss of a single particle of iron or coke. All sweepings and siftings from the gangway may be distributed among other charges or can be added to this last charge. When the breast is knocked in all this slag will run out.

If any iron runs out with the slag it drops through the pool of slag to the floor and in a slab can be removed when the slag is broken up next morning.

This saves handling, mill tending, mill repairs and saves the power to drive the mills. It holds the heat in the cupola and costs nothing.

It is strange that this method is not used in every foundry.

ONE OR TWO ROWS OF TUYERES.

Question. — We are making light castings and light machine work. The cupola is 28 inches inside of lining. The four tuyeres are placed 28 inches above the drop doors. Diameter of tuyeres five inches. I intend to arrange a second row of four tuyeres, four inches diameter, above as I think the melting will go a little faster and the iron come out hotter. What would be the right height of the second row and what diameter

should they have? How high should the bed of coke be above the top row and what is the best charge of iron?

Answer.—When two rows are used, the upper row is generally quite small and say about eight inches above the lower row. I have never seen any reason for two rows. If you think that you need more wind, place eight four-inch tuyeres in the first row. This would give 96 square inches better distributed than the 73 inches you now have.

The coke should be 12 inches above the tuyeres and a second row requires a deeper bed; 350 pounds of iron would be a good charge and about 50 pounds of coke. By being careful about even charging and making scrap small the charge of iron may be increased to 400 pounds.

OPEN-HEARTH STEEL CASTINGS—IX.

By W. M. Carr.

Blow Holes in Steel Castings.

A common source of annoyance is found in porosity or in unsoundness. The ingot manufacturer finds it comparatively easy to get around such drawbacks by liberal discards or end cropping of ingots usually more or less spongy or blow-holed at the upper end. Not so with the production of castings. The problem of pouring liquid steel into the green or dry sand molds has a distinctive complexity in comparison with casting into ingot molds made of iron or dry sand with simple lines or shapes.

Blow holes in a steel casting may be due to a variety of causes. They must not be confounded with "shrink holes" or cavities due to a difference in the rate of cooling of parts contrasting in dimensions. A light section in junction with a heavier one will cool faster and in doing so will draw upon the heavier and more liquid section, thus depleting it of steel, with the result that in the heavier section there will be some voids. Hence the important reason for forming larger headers or reservoirs to hold a supply of steel from which the casting below can make drafts to offset the contraction in cooling. Frequently in separating such headers rough irregular cavities will be found at the joint of the header and the castings which are known as "shrink holes," (see Fig. 1) and may be formed even in cases of the casting being free from "blow holes."

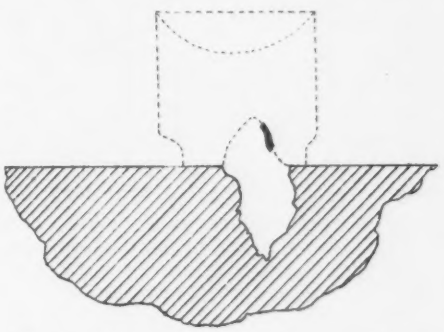


Fig. 1.—Shrink Hole. Dotted Outline Shows Position of Riser.

The position of cavities or pores, due to either gases or shrinkage, will determine their identification.

Blow holes may be found in any part of a machined or fractured casting. Shrink holes occur only at certain points. They are irregular in shape, with rough surfaces, but upon close examination will be found covered with delicate, minute crystals. The walls of a shrink hole are usually the same color as the metal itself, provided no air was present while the casting was hot. Blow holes are always the result of air, vapor or gas. Their shape as a rule is oblong, lenticular or spherical. If oblong in shape they are due to metal being imperfectly deoxidized or "killed" and they will always be found with their axes or longest dimensions at right angles to the cooling surface of the body of metal (see Fig. 2). If they are globular or spherical they are caused by vapor or air and not by gas or gases, the result of chemical action within the metal, but by damp sand, imperfect venting—details of molding. While it is perfectly possible (and is

regularly done) to get sound, solid steel machinery castings from green sand molds, accidental causes may make the sand too damp. In that case there may be blow holes because of an excess of steam or aqueous vapor formed by the hot steel.

If the green sand mold should possess the right "temper" and globular, spherical holes still be found, there may be two causes effective. One may be that the sand, green or dry, is too close or too strong, preventing a free escape of the gases as they are formed by the heat of the inflowing steel upon such binders as may be used to give body to the sand and cores. Evidence of that may be seen in fractured castings, which will have a solid drag side, but a more or

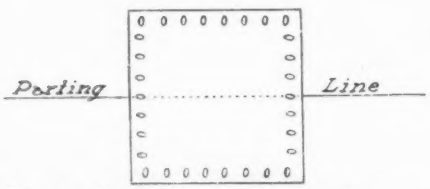


FIG. 2.—BLOW HOLES CAUSED BY GASEOUS STEEL, IMPERFECTLY DEOXIDIZED.

less porous cope side (see Fig. 3). A casting blown because of gaseous or improperly "killed" metal will be more or less spongy at all points of both drag and cope. Porosity is often caused by failure to freely vent the highest points of the cope which will cause air pockets to be formed which the liquid steel may not be able to displace and such conditions as described can occur in spite of dry and good green sand molding or properly deoxidized steel. Thus it will be understood that in spite of the highest skill manifested in the melting department, it may be nullified by conditions on the molding floor. A study of the daily discard in the scrap pile as it is broken up will be a good guide, as to what errors are being made in practice, and with a slight knowledge of the causes of porosity one can greatly modify faults.

If the chemical analyses are normal, that is, the figures on manganese and silicon, are within usual limits, but blow holes of the oblong character are persistent, the cause can be traced to the furnace platform.

There may be too sharp a melting flame, too much air admitted for flame combustion, or a too liberal use of ore in refining. Either one of these conditions will surcharge the metal with oxide beyond the influence of the usual addition of the deoxidizers, manganese or silicon. Such practice may be covered up or lessened by an increase of deoxidizers, but always at the sacrifice of the physical requisite

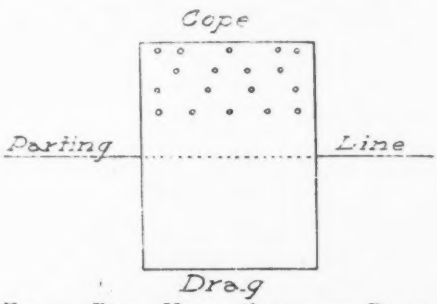


FIG. 3.—BLOW HOLES CAUSED BY DAMP SAND, VAPORS FROM CORE BINDERS OR IMPERFECT VENTING.

in steel castings, toughness. The The writer knows from his experience in advanced steel casting practice in either green or dry sand, acid or basic steel, that it is possible to produce sound castings free from pin holes or blow holes which will satisfy the most exacting demands. Still there is no royal way to the production of sound castings. It is fraught with patience, skill, study and industry.

The McWane Pipe Works, which is a department of the Lynchburg Foundry Co., of Lynchburg, Va., is sending out a unique catalog measuring over all 4 x 9 inches. The sheets are cut to the form of a piece of iron pipe and secured together with a cord. The 26 pages of catalog matter contained in the publication is well written and illustrated and contains tables of sizes and proportions of pipe coupling, specials, etc.

Among the Foundry Supply Fraternity.

CHICAGO PLANT OF THE S. OBERMAYER CO.

This plant is located in the city of Chicago in the block bounded by West Eighteenth and Rockwell streets, the Penna. railroad on the east side and the C. B. & Q. railroad on the south side.

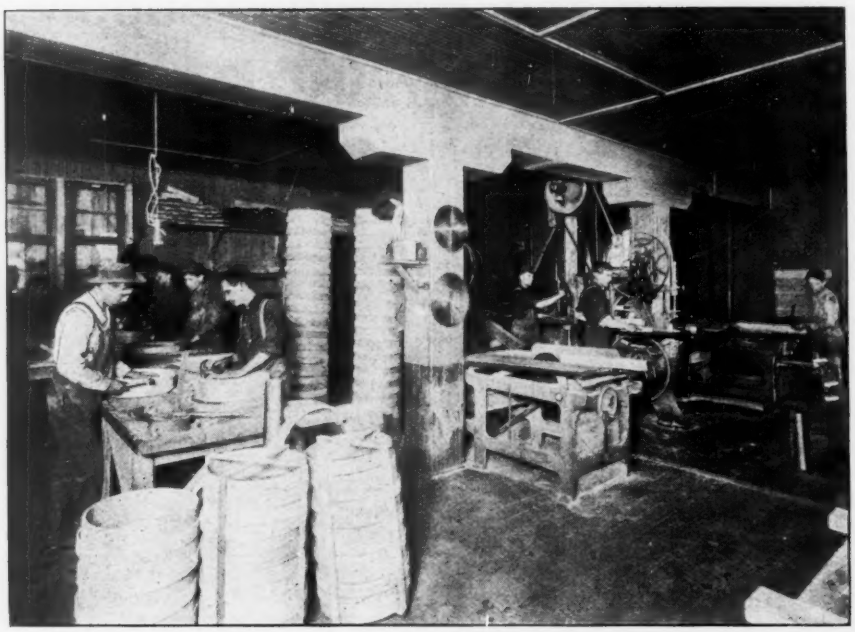
The main building consists of a four-story brick building with basement, 100 x 100 feet, facing Rockwell street. In connection with the above are a number of smaller buildings for the storage of raw material and finished product. An office building, which is a recent addition, is located at the corner of Eighteenth and Rockwell streets. This office building is a modern structure, brick building, one story high, and well equipped for the purpose for which it was erected.

The main building is divided by a fire wall, the north half of the main building being used for the manufacture of foundry facings and the reduction and refining of plumbago or graphite. In this building ten mills are operated for the reduction of graphite, the capacity being about 10 tons per day. Besides the above, there is a special large mill for the reduction of graphite with an air separating process, which reduces the graphite to an impalpable dust. This is probably the largest mill in operation in this country for this purpose.

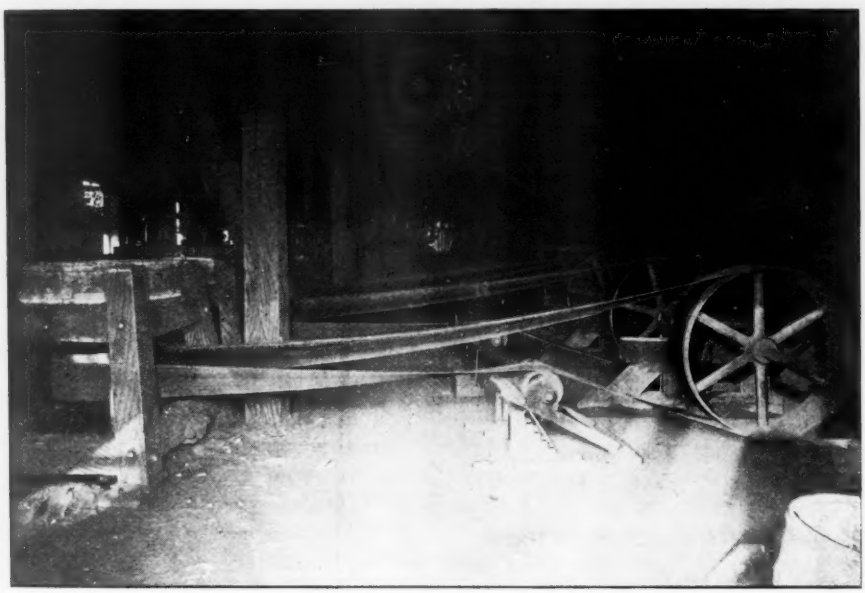
OFFICE, FACTORY AND YARDS OF THE S. OBERMAYER CO., CHICAGO, ILL.

In the manufacture of mineral facings, soapstone facings, and various other grades special burr mills, emery mills, bolting reels and special conveying machinery are used.

For the manufacture of sea coal facing this company has a special building so that the sea coal facing does not come in contact in any manner with the higher grades of plumbago and other foundry facings. This special sea coal plant has a capacity of 50



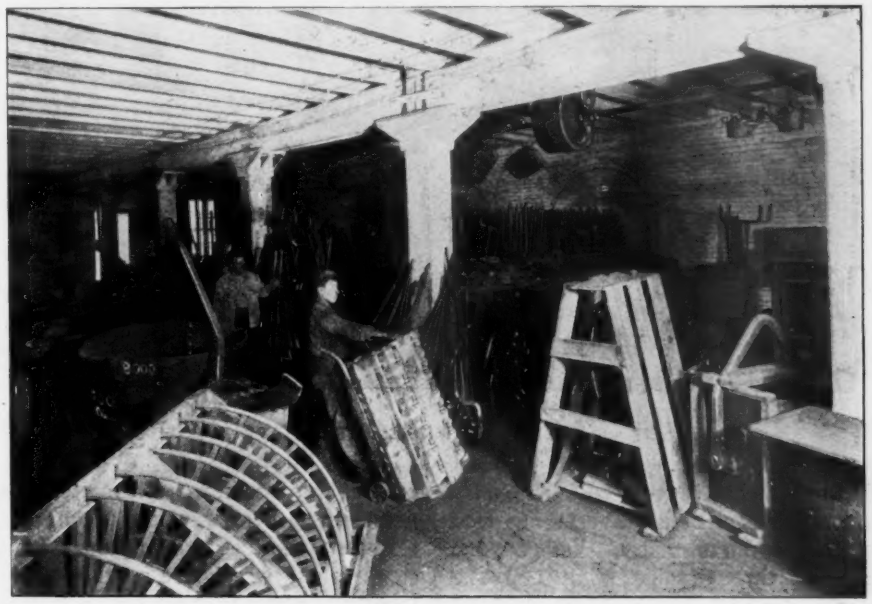
WHERE RIDDLES ARE MADE.



ONE OF THE GRINDING ROOMS.

tons per day, the machinery consisting of a coal dryer built especially for this purpose, the material being conveyed direct from this dryer by elevators and conveyors to the three grinders and from thence conveyed to the packers, which packs the material in bags or barrels as wanted.

The most remarkable point is that with the present capacity of almost 100 tons of all kinds of assorted facings, very little actual labor is required, all the materials being handled by machinery, and that after the crude material once starts into the process it is not handled by men, but by machinery conveying the finished product direct into the packages in which it is shipped to the foundries for use.



ONE OF THE STORE ROOMS.

In the wood-working department flasks of all kinds, riddles, bellows, floor and bench rammers, brushes, sand-sifting machines, tumbling barrels, clamps, etc., are manufactured. This room is 35 x 75 feet, inside dimensions. The latest improved machinery for the manufacture of these goods is installed, including lathes, jointers, dovetailing machines, band and circular saws, wood-turning lathes, drill presses, punches and shears, wire cutting and boring machines, all belt driven. About twenty-five men are constantly employed in this department under the supervision of C. H. Green, formerly of Syracuse, N. Y.

In the yards are buildings for the storage of raw and finished products connected by an industrial track system, which is directly connected with the company's private switches running in from the C. B. & Q. railway and the Penna. railroad.

In the fire brick department the buildings are so arranged with track service, that one to two million fire brick, cupola blocks, etc., can be stored and handled with but little trouble. Off from this building is another drying house, 25 x 25 feet, where all the crude material is tested and dried before entering into the manufacturing processes.

Besides the foregoing buildings, there are five or six structures for the storing of manufactured material, also crude material connected with the industrial railroad system to the various parts of the plant. Power is developed by a 450-horsepower Allis-Chalmers Corliss engine and transmitted to the different parts of the plant by a complete system of rope drives. The power plant is a separate building adjoining the main building.

This company endeavors to manu-

PART OF THE WOODWORKING DEPARTMENT.

facture all that is required for foundry use and advertises "Everything you need in your foundry," and anyone can go through this plant and the warehouse and see the large stock of the various articles, not only in the way of foundry facings and supplies, but also in the way of equipment, such as tumbling mills, ladles, brass melting furnaces, of which there are hundreds and hundreds stacked in the warehouse of different sizes and shapes for immediate shipments.

The location of the company's three plants for the manufacture and distribution of foundry facings, supplies and equipments in the most important centers of the foundry industry, Cincinnati, Chicago and Pittsburg, with factories and warehouses of similar kinds at each of these places, has much to do with the growth and success of this business. No matter how great the order or what it calls for, shipment can be made at once from stock in the warehouse nearest to the foundry's place of business, a facility which is to the advantage of both parties.

The S. Obermayer Co. is general sales agent for many of the important specialties required by foundries, including those of the Whiting Foundry Equipment Co., for the territory west of and including Pittsburg.

FIG. 1.—A METALLIC CORE VENT.

A METALLIC CORE-VENT.

All foundrymen know that there is a very large class of intricate cores which require both rodding and venting and frequently solid rods interfere seriously with the venting of such cores. To overcome this difficulty, H. C. Caldwell, of Philadelphia, has invented a metallic core-vent which is

now manufactured by the Metal Core-Vent Mfg. Co., with offices at 416 Mutual Life building, Buffalo, N. Y.

This vent consists essentially of a metallic ribbon twisted into a tube, as shown in one of the accompanying illustrations.

The twisting is close enough so that the edges of the ribbon have a bearing along the seams in such a manner as to give great stiffness to the vent. The seams, however, are sufficiently open to permit the gases to flow into the center tube. For straight work this core-vent forms both a rod and a vent or passage. For curved work the vent may be bent to any desired

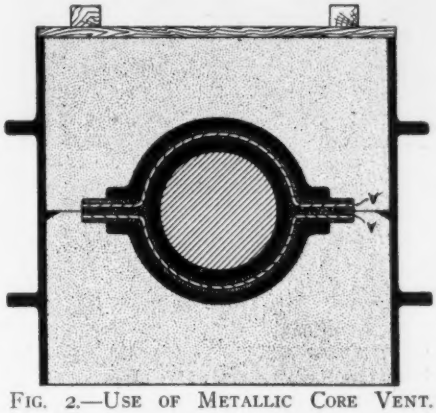


FIG. 2.—USE OF METALLIC CORE VENT.

shape, as for instance, in the two halves of the jacket core shown in Fig. 2 the vents have been bent and brought out through core prints at the side, as shown at AA. There are a great many places where this style of vent will be found exceedingly useful. When the vent is bent the seams will open somewhat and in order to prevent the sand entering, these open joints are filled with any kind of wax, such as paraffine, beeswax, etc. The wax melts out during the baking of the core and thus assures a free and open vent, while the metal still gives stiffness to the core. One of the important points claimed for this core-vent is that it is not as liable to buckle or bend cores on account of expansion of the metal, as is the case with solid rods.

These core vents can also be used over and over again in cases where they can be removed as the core is taken out.

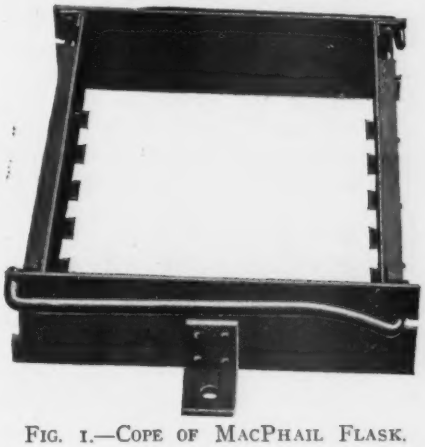


FIG. 1.—COPE OF MACPHAIL FLASK.

It is also claimed that a much cheaper core mixture can be used in many cases, as the substitution of the combined vent and rod makes a stiffer core than can be obtained even with an oil sand core under the old system of construction.

A NEW FOUNDRY FLASK.

All foundrymen are familiar with the shortcomings of the snap flask and know how frequently snap flask work is spoiled on account of run-outs which

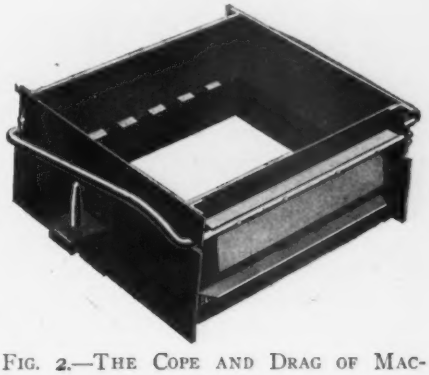


FIG. 2.—THE COPE AND DRAG OF MACPHAIL FLASK COMPLETE.

result not only in loss of castings, but in burning of the bottom boards. To overcome these difficulties the MacPhail

Flask & Machine Co., 1270 Monon Bldg., Chicago, Ill., has brought out a new form of flask, which is shown in the accompanying illustrations. It is made entirely of sheet steel. Cope and drag have a uniform taper toward the bottom board. To hold the sand in the cope while it is being turned over, a series of projecting lugs or fingers are provided near the parting line of the flask; these are controlled by the levers shown at the ends of the cope part of the flask. By depressing the levers a short distance, the lugs are withdrawn, thus releasing the sand. After the mold is completed the sand is released and the flask, on account of its taper form, easily lifted off.

To support the sand during pouring a sheet steel jacket, made of metal of the same thickness as the flask, and having exactly the same taper is dropped about the mold. This supports the sand

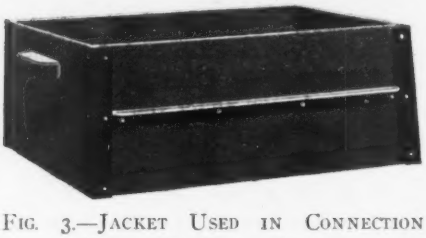


FIG. 3.—JACKET USED IN CONNECTION WITH MACPHAIL FLASK.

perfectly at all points and makes it possible to place the casting very close to the outside edge of the flask. In other words, this arrangement gives the advantage of a complete steel flask without its attendant expense.

The jackets can be readily removed from one mold to another so that it is claimed that where 125 molds per day are put up on a machine it is only necessary to have one of the MacPhail self-releasing flasks and six steel jackets. The jackets being self-releasing are moved from one mold to another as they are successively poured.

A NEW FLASK CLAMP.

In connection with the roll-over molding machine recently brought out by the J. W. Paxson Co., which was

FIG. 1.

described in the September issue of THE FOUNDRY, it was necessary to provide some easily adjusted flask clamp

FIG. 2.

which could be used for holding the bottom board in place when the flask was rolled over. This resulted in the designing of the clamp shown in the accompanying illustrations, which has since been patented and is now being manufactured by the J. W. Paxson Co., of Philadelphia. The clamp consists of but three parts, namely, the bar and clamping piece and a short pin to prevent the clamping piece from falling off from the bar. In adjusting the clamp it is very important that the toe of the clamping piece be placed as near the edge as possible.

The method of applying the clamp is shown in Fig. 1. After the toe has been placed in contact with the lower portion of the flask, the upper end or hook is brought to a bearing as shown in Fig. 2. The rectangular hole in the toe clamps the bar firmly and the angle of the under side of the hook is made such that as it is pressed forward in the manner shown in Fig. 3, the parts will be drawn together. If care is taken to place the toe exactly as shown the clamp can be applied in such a way as to bring a great pressure to bear upon the boards. It can, however, be instantly released by striking the toe a blow as shown in Fig. 4. The angle of the hook has to be varied for different lengths of clamp, as it must be such that a circle struck from the point of the toe will never be more than tangent to the hook. In other words, if the circle passes through the base of the hook there must be a slight angle between the tangent of the circle and the hook.

FIG. 3.

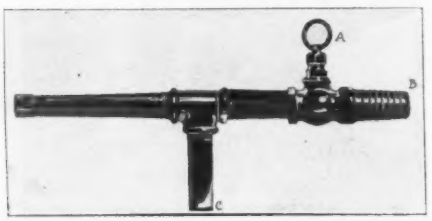
FIG. 4.

The application of this clamp when made in the right way is exceedingly simple and effective, but if the toe is placed too far back under the flask it will be found impossible to bring it to a good bearing.

A HIGH PRESSURE SAND BLAST.

Most of the sand blasts in use operate with a low air pressure. This necessitates one of two things. First, the introduction of a special blower or compressor to furnish air for the sand blast at a proper pressure, and, second, the reduction of the pressure on the

regular air line to that necessary for the sand blast. The former arrangement requires duplicate apparatus which is only in operation part of the time, while the latter arrangement is very wasteful of power. To overcome these difficulties, a sand blast has been brought out by the Cooper Process Co., of Buffalo, N. Y., which operates with the ordinary air pressures of from 80 to 90 pounds per square inch.



A High Pressure Sand Blast.

Another advantage of this particular style of sand blast is that the sand is siphoned to the apparatus from a pail or any other convenient receptacle. The general arrangement is shown in the accompanying illustrations, the air hose being connected at the right hand side at the point indicated in the drawing. The suction hose is attached to the nipple, which extends down vertically, and the sand is projected out through the pipe at the front end of the apparatus.

It is claimed by the manufacturers that this apparatus can be operated by unskilled labor and will clean between two and three square feet of surface per minute.

This sand blast was first developed for use in cleaning paint or rust from structural steel, but has proved so successful that it has been applied to the cleaning of castings. The entire device weighs but five pounds and is intended to be attached to a 1¼-inch air hose.

GENERAL INDUSTRIAL NOTES.

The Vermont Construction Co., Burlington, Vt., organized with a capitalization of $100,000, has taken over the plant of Lang & Goodhue, at Burlington. In addition to engineering and construction work a general repair and foundry business will be carried on.

The Holyoke Motor Foundry Co., Holyoke, Mass., has been organized with a capitalization of $100,000 to deal in iron, steel, brass, etc. The incorporators are: Lewis Sanders, Nyack, N. Y.; Edward T. McHugh, 194 Sargent street, Holyoke, and F. F. Bennett.

The Bristol Co., Waterbury, Conn., manufacturer of recording instruments, has opened a branch office at 753 Monadnock building, Chicago, Ill.

The Rockland Machine & Foundry Co. has organized to manufacture hydraulic dredging machinery. The capital stock is $10,000 and the incorporators are: William E. Blakeslee, Hilburn, N. Y. and Gustavus L. Cudner, 210 West Thirteenth street, New York.

The Plattsburg Foundry & Machine Co. and the Cedar Point Foundry Co., Plattsburg, N. Y., have consolidated and will hereafter be known as the Plattsburg Foundry & Machine Co. The officers are: John M. Weaver, president; John Ross, vice president and treasurer; F. E. Tromblee, secretary, and Theodore Tromblee, general manager.

The Rochester Implement Co., incorporated with a capital stock of $7,000, will manufacture machinery, tools, agricultural implements, etc. The incorporators are: William H. Rowerdink, Charles L. Aird and Wallace P. Frisch, all of Rochester, N. Y.

The Morris Coupling Co. has been incorporated with a capital stock of $8,000 to manufacture shaft couplings and collars. The incorporators are: Windsor Morris, Herbert Robinson and Howard M. Baldwin, Baldwinsville, N. Y.

The Bell & Fyfe Foundry Co. has now moved its office and foundry from Brooklyn, N. Y., to Halsey street and East river, Astoria, L. I., and is equipped to handle castings up to 50 tons in weight. Machinery castings in iron, bronze or composition are manufactured.

The business of Maris Bros., Philadelphia, formerly carried on by Frank Maris, Charles E. Maris and M. B. M. Tatum, will in future be conducted by Frank Maris and Charles E. Maris, Mr. Tatum having retired from the company Oct. 1.

The business formerly conducted by the Portsmouth Harbison-Walker Co., Portsmouth, O., will in future be handled by the Harbison-Walker Refractories Co., Pittsburg, Pa., and all communications should be addressed to that office.

The Electric Controller & Supply Co., Cleveland, O., has opened a Chicago office in the Merchants Loan and Trust building, 135 Adams street, with W. M. Connelly in charge. Mr. Connelly was connected with the electrical department of the Homestead works of the Carnegie Steel Co. for five years, then became electrical engineer for the Ensley plant of the Tennessee Coal, Iron & R. R. Co., Birmingham, Ala., and later conducted the sales department in central station work at Houston, Tex.

The Bellefontaine Foundry & Machine Co., Bellefontaine, O., has increased its capital stock from $75,000 to $125,000.

The Steel Foundry Co., Cincinnati, O., has increased its capital stock from $100,000 to $200,000.

The Machinists' Foundry Co., Muncie, Ind., has been incorporated with a capital of $10,000. The incorporators are Frank Burt, Cary Crozier, H. P. Gerdau, W. H. Moon, John M. Stetter, Fred C. Kaiser and A. L. Bingham.

The firm of Madden & Co., Rushville, Ind., has been incorporated with a capital of $25,000, to carry on an iron and brass foundry business. The incorporators are: J. W. Arbuckle, Stephen Kelly and Wallace Morgan. A foundry, 50 x 100 feet, and a two-story machine shop, 50 x 130 feet, will be erected.

The Armor Steel & Foundry Co., with a capitalization of $1,000,000, has been organized for the operation of an open-hearth steel plant at Joliet, Ill. George P. Swift, of Chicago, is president and William B. Moore, secretary of the company, with headquarters in the Marquette building, Chicago. A site of fifteen acres in Joliet has already been purchased, the contract for the buildings and furnaces has been let, and construction work will be started as soon as plans are completed. The plant will begin operations with a furnace having a capacity of 30 tons per day and a force of about 100 men.

On Sept. 10 the Independent Pneumatic Tool Co., Chicago, held its annual meeting in Jersey City, N. J., and elected the following officers and directors for the ensuing year: President, James B. Brady; 1st vice president, W. O. Jacquette; 2nd vice president, John D. Hurley; treasurer, C. E. Erikson; secretary, A. B. Holmes. Directors: John R. Turner, John P. Hopkins, W. O. Jacquette, James B. Brady, John M. Glenn, Simon Florsheim, C. E. Erikson, John D. Hurley, J. J. McCarthy. The company announces that it is planning a large addition to its plant at Aurora, Ill.

The United States Pipe Co., Chicago, Ill., has been incorporated to manufacture, buy and sell iron pipe, castings, fittings, iron and steel products, ores, etc. The capital stock is $50,000, and the incorporators are: Ed. W. Everett, W. H. Jacobs, B. Esterline, E. C. Maher and A. C. Marriott, all of Chicago.

The H. C. Chase Foundry Co., of Chicago, has changed its name to the U. S. Yards Foundry Co.

The Featherstone Foundry & Machine Co., Chicago, Ill., has increased its capital stock from $250,000 to $400,000.

The Paul-Luttman Co., Menasha, Wis., has been organized with a capital of $15,000 to conduct a foundry and machine shop business. The incorporators are: Arthur D. Paul, John W. Luttman and W. L. Wheeler. The foundry and machine shop of A. E. Jennings has been purchased and new machinery will be installed.

THE FOUNDRY

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TRADE OUTLOOK.

The past month has shown some radical changes in the pig iron situation. As THE FOUNDRY goes to press the market is in a run-away condition, and it is very difficult indeed to say what prices really are. Some carload lots of No. 2 foundry iron have been sold in Pittsburg as high as $25 per ton for prompt delivery, while the price quoted for deliveries during the first half of 1907 is $19.50 valley furnace for No. 2 foundry. No. 2 foundry is now selling at $16 Birmingham for delivery during the first half of next year, much higher prices being paid for spot iron.

Although the weather has been good in the north, there is a marked car shortage, and it is evident that there is going to be a great deal of trouble in securing a sufficient number of cars to move the freight throughout the winter.

The coke market is also in a bad condition, and the H. C. Frick company, which is the largest producer of coke, has had to go into the open market and purchase 360,000 tons for delivery in 1907. It is an exceedingly fortunate thing for the foundrymen throughout the country that a large number of by-product plants have been started in different places and hence by-product foundry coke is available to take the place of the old standard Connellsville article.

As mentioned in last month's FOUNDRY, the advance in the price of iron ore, as well as the advance in the price of coke, will tend to keep the price of pig iron at a high level. It is sincerely to be hoped that the present market conditions will not become any more acute and will not, as is often the case, terminate with a slump on account of the fact that the high prices stifle business.

All of the different foundry lines, including gray iron, steel and malleable, report large tonnages, and most of them have orders enough on their books to keep them busy for several months. The prices at which most of this work has been taken, however, are such that the margin of profit must be exceedingly narrow on account of the greatly increased cost of production.

ASSOCIATIONS AND SOCIETIES.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of the Bar bour-Stockwell Co., Cambridgeport, Mass.

The regular monthly meeting of the New England Foundrymen's Association was held Oct. 10, at the Exchange Club, Boston. Dinner was served at six o'clock, after which the routine business of the evening was disposed of in the usual manner, President W. B. Snow presiding.

The death of Edgar B. Pierce, of the Wheeler Foundry Co., Worcester, was reported and the chair appointed Messrs. C. E. Hildreth, J. F. Kyes and L. A. Colvin, a committee to prepare resolutions.

Announcement was made that owing to the convention of the National Founders' Association falling on the same day as the next meeting of this association, the executive committee had decided to hold the next meeting at Boston instead of New Haven as previously arranged, and Dr. Richard Moldenke, of Watchung, N. J., would be the principal speaker.

The president then introduced Mr. E. Stutz, of Goldschmidt Thermit Co., New York, who gave an illustrated talk on thermit heating and welding compound as applied in foundry practice.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

Discussion of plans for the entertainment of the annual convention of the American Foundrymen's Association, which will be held in Philadelphia next May, occupied the greater part of the monthly meeting of the local association of that city, which was held at the Manufacturers' Club on the evening of Oct. 3. President Thomas Devlin, who was in the chair, announced the appointment of the following committee of entertainment, which will have general charge of the local arrangements:

Dr. E. E. Brown, E. E. Brown & Co.; A. E. Outerbridge Jr., Wm. Sellers & Co.; S. G. Flagg Jr., S. G. Flagg & Co.; C. S. Asbury, Enterprise Mfg. Co.; J. M. Jaycox, Ernest Law & Co.; W. S. Hallowell, Harrison Boiler Wks.; Geo. C. Davies, Pilling & Crane; W. O. Steele, Bateman Mfg. Co.; Geo. R. Sullivan, Rogers, Brown & Co.; E. H. Mumford, E. H. Mumford Co.; Thos. Evans, Eynon-Evans Mfg. Co.; Edgar S. Cook, Warwick Iron & Steel Co.; J. H. Sheeler, Sheeler-Hemsher Co.; Geo. C. Davis, chemist; Cyrus Borgner, Cyrus Borgner Co.; A. A. Miller, *Iron Age;* W. H. Ridgway, C. Ridgway & Son Co.; W. W. Heanne, Matthew Addy & Co.; Thos. Devlin, Thos. Devlin Mfg. Co.; Howard Evans, J. W. Paxson Co.; W. H. Taylor, Geo. V. Cressen Co.; J. Thompson, J. Thompson & Co.; Frank Krug, Dixon Crucible Co.; H. O. Evans, Thos. Devlin Mfg. Co.; W. H. Taylor, Geo. V. Gresson Co.

The meeting was made unusually interesting by the presence of W. H. McFadden, president, and Dr. R. H. Moldenke, secretary, of the American Foundrymen's Association, and H. M. Lane, secretary of the Foundry Supply Association, all of whom spoke of the efforts being made to make the coming convention a success. President McFadden said it was expected to be the largest gathering of the American Foundrymen's Association ever held, with not less than 1,000 persons in attendance. He appealed for a deeper interest in the national body and a closer affiliation with it. Mr. Lane referred to the very successful convention held in Cleveland and touched upon the educational value of such gatherings and their help to foundrymen.

The technical paper of the evening was read by Geo. C. Davis, official chemist of the association, on "A Short Description of a Flat Casting like Stove Plate that is Chilled on the Inside and Gray on the Out." The Hillis & Jones Co., of Wilmington, Del., represented by J. S. Sterling, was elected to membership.

While no definite program has as yet been arranged, Mr. Lane and Dr. Brown, chairman of the entertainment committee, stated that it was proposed to hold the convention in the Second Regiment armory, with headquarters for the delegates at the Hotel Majestic, and that

trips were contemplated to Cramp's ship yard, the Warwick Iron & Steel Co.'s plant, League Island navy yard, Washington Park, the coke plant in Camden, Baldwin Locomotive Works, Link Belt Engineering Co. and other points of attraction.

Dr. Moldenke pointed out the value of the American Foundrymen's Association to all those in the foundry business and announced that a feature of the coming convention would be an invitation to brass foundrymen and workers in aluminum and other metals to attend and form a national organization.

Other addresses urging vigorous action in behalf of the convention and in support of the American Foundrymen's Association were made by Stanley Flagg Jr., President Devlin, who suggested a special display of fine castings, Secretary Evans, H. E. Field, of Pittsburg, and others. Dr. Brown announced that the entertainment committee would meet for organization on the same evening as the next meeting of the Philadelphia association.

Pittsburg Foundrymen's Association.

F. H. Zimmers, Secretary, care Union Foundry and Machine Co., West Carson Street.

The first meeting of the Pittsburg Foundrymen's Association since the summer season was held at the Colonial Annex hotel in that city, on October 8. The meeting was preceded by a dinner, at which B. D. Fuller, the retiring president, acted as toastmaster. There was a large attendance and a number of interesting addresses were made. Among those addressing the meeting were W. H. McFadden, president of the American Foundrymen's Association, J. S. Seaman, of the Seaman-Sleeth Co., S. D. Sleeth, Westinghouse Air Brake Co., D. J. Thomas, of the Sterritt-Thomas Foundry Co., and H. E. Field, of Mackintosh, Hemphill & Co. The principal address of the evening was made by Hon. James Francis Burke, congressman from the Pittsburg district. The address was devoted chiefly to showing the greatness of Pittsburg as a manufacturing center, and the fact that the foundry interests had helped greatly in this development. The annual report of the secretary, F. H. Zimmers, was read and showed that the membership of the association is constantly increasing and that its affairs are in a very prosperous condition.

An election of officers was held which resulted as folows: Henry P. Spiker, Sterritt-Thomas Foundry Co., president; H. E. Field, Mackintosh, Hemphill & Co., vice president; J. S. Seaman, Seaman-Sleeth Co., treasurer and F. H. Zimmers, secretary. An executive committee was also elected consisting of W. H. McFadden, S. D. Sleeth, E. A. Kebler, B. D. Fuller, and J. S. McCormick

British Foundrymen's Association.

F. W. Finch, Kingston House, Lonsdown Rd., Gloucester, Eng., Secretary.

The Birmingham branch of the British Foundrymen's Association has now issued its program for the coming season, which is as follows:

Oct. 20, paper "Carbon and Cast Iron," Stansbie, B. S. C. F. I. C. Nov. 17, "Shrinkage and Volume Alteration During Cooling," Professor T. Turner, M. S., C. Associate R. S. M. Dec. 15, "Molding Sands," P. Longmuir, Carnegie Gold Medalist. Jan. 19, "Characteristics of Foundry Irons," G. Hailstone. Feb. 16, "Microscopical Testing of Cast Iron," O. F. Hudson, B. S. C. A. R. C. S. March 16, "Pig Iron Specifications and Sampling from a Maker's Point of View," H. Pilkington, M. I. C. E. April 20, General meeting and election of officers. May 18, "Tensile Testing of Cast Iron," F. J. Cook. The various visits have already been referred to; they are to be four in number, and are expected to include the Summer Lane Electric station, and the Mond works, Dudley Port. The latter visit will have specially in view the possibility of utilizing this kind of power for foundry purposes, for which it is believed there is a good opening in the district.

At the meeting of the council of the association, held on Sept. 29, very great satisfaction was expressed with the special report of the Middlesborough convention, which appeared in the September issue of the FOUNDRY, and especially with the courtesy of the editor in sending copies to each member. It is rather likely that this report will be adopted as the special official report of the association.

Cleveland Foundry Foremen.

H. M. Lane, 610 Schofield Bldg., Secretary.

The first regular meeting of the Cleveland foundry foremen since the summer vacation was held in the parlors of the American house, Saturday evening, Sept. 29. There was a good attendance, president Hugh Mackenzie being in the chair. The meeting was devoted largely to the best methods of arranging programs for the coming year. A program committee was appointed and arrangements made to secure topics for discussion at the next meeting.

Milwaukee Foundry Foremen.

Julius M. Germanson, 931 Allis Street, Secretary.

The regular meeting of the Milwaukee Foundry Foremen's Association was held at the rooms of the Metal Trades' Association on Oct. 8. There was a large attendance and Mr. S. T. Johnston, of Chicago, who has charge of the foundry equipment department of the S. Obermayer Co., read a very instructive and interesting paper on foundry appliances and equipment. This was followed by a discussion of various subjects relating to foundry practice.

AMERICAN FOUNDRYMEN'S ASSOCIATION.

Dr. Richard Moldenke, Secretary, Watchung, N. J.

PACIFIC COAST FOUNDRYMEN'S ASSOCIATION.

J. D. Morris, Secretary and Treasurer, Seattle, Washington.

BUFFALO FOUNDRYMEN'S ASSOCIATION.

John E. Gorss, Secretary, 23 Builders' Exchange.

THE ASSOCIATED FOUNDRY FOREMEN.

Frank C. Everitt, care the J. L. Mott Iron Works, Trenton, N. J., Secretary.

PHILADELPHIA FOUNDRY FOREMEN.

W. P. Cunningham, Secretary, care American Bridge Co., Pencoyd, Pa.

CINCINNATI FOUNDRY FOREMEN

E. W. Cadwell, Secretary, care S. C. Tatum Co.

CHICAGO FOUNDRY FOREMEN.

Mr. Thompson, Link Belt Co., District Vice Pres.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.

C. H. Thomas, 14 Elizabeth St., So. Norwalk, Conn., District Vice President.

ERIE FOUNDRY FOREMEN.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

INDIANAPOLIS FOUNDRY FOREMEN.

W. S. Keller, of Hetherington & Berner Co., District Vice President.

HAMILTON, ONT., FOUNDRY FOREMEN'S ASSOCIATION.

A. Chase, care Sawyer & Massey Co., Secretary and Treasurer.

Meeting of the Cleveland Club of Associated Patternmaker Foremen.

H. J. McCaslin, care Wellman-Seaver-Morgan Co., Secretary.

The first regular meeting after the summer vacation was held in the offices of the Penton Publishing Co., Browning building, Monday evening, Oct. 8. There was a fair attendance and Mr. J. Nall read an exceedingly interesting paper on the method of preparing patterns for molding a large casting which was required for a jig. Only one of these castings was required and hence it was desired to make the pattern work on it as simple as possible. The reading of the paper brought out considerable discussion, which was followed by a general discussion on patternmaking subjects. The club is in a flourishing condition and the prospects seem exceedingly bright for a good and profitable series of meetings through the coming winter.

FOUNDRY SUPPLY ASSOCIATION.

Mention was made in the October issue of THE FOUNDRY of the progress made in adopting the constitution and other points in the development of the Foundry Supply Association which was organized at the Cleveland convention of the American Foundrymen's Association to co-operate with the latter mentioned body. No regular campaign for membership has as yet been started, as the officers have been waiting for the acceptance of one or two of the trustees, and to get the plans a little better worked out before any circular was sent out. In the meantime, however, a large number of applications are coming in voluntarily and the preliminary arrangements for the Philadelphia convention have largely been made, so that the success of the convention and of the organization seems assured. The constitution as adopted is as follows:

CONSTITUTION.

ARTICLE I.

NAME.

The name of this Association shall be "The Foundry Supply Association."

ARTICLE II.

OBJECT.

First. The object of the Association shall be to co-operate with the American Foundrymen's Association for the general betterment of the foundry trade, by the introduction of improved methods, machinery, etc., into foundries. To carry out this work to the best advantage, the Association shall meet at the annual convention of the American Foundrymen's Association and shall, whenever deemed advisable, hold an exhibition of foundry supplies and equipment in connection with the said convention.

Second. The Association shall co-operate with the American Foundrymen's Association and the local foundrymen in the city where the annual convention is held, in arranging for the entertainment features.

ARTICLE III.

MEMBERSHIP.

Any firm, corporation or individual manufacturing or dealing in foundry supplies and equipment or material used in the foundry business, who shall take part in the adoption of this Constitution shall, upon payment of the initiation fee, become a charter member of the Association, and thereafter any such firm, corporation or individual may become a member upon application in writing to the Executive Committee, the approval of the application by the said Committee, and by paying the initiation fee.

ARTICLE IV.

SECTION 1. The officers of the Association are to be the President, First and Second Vice Presidents, a Secretary and a Treasurer. These officers shall be elected at the annual meeting and hold office until their successors are elected.

SEC. 2. There shall also be six trustees, two of whom shall be elected each year, after the first year, and shall hold office for three years.

SEC. 3. The above mentioned officers with the trustees shall form the Executive Committee, of whom six present shall constitute a quorum.

SEC. 4. The Secretary shall receive for his service a salary of $500.00 per year, and the Treasurer a salary of $50.00 per year.

SEC. 5. The Treasurer shall be required to furnish a $4,000.00 bond and the Secretary a $1,000.00 bond, both of which shall be paid for by the Association.

SEC. 6. It shall be the duty of the Treasurer to receive all moneys from the Secretary and to receipt therefor, to keep an accurate account of all moneys and to make a report to the Association at the time of the annual convention. The Treasurer shall pay bills which have been approved by the Secretary or by two other members of the Executive Committee in the absence of the Secretary.

SEC. 7. It shall be the duty of the Secretary to keep the records of the Association, send out notices of meetings, arrange for the annual convention and exhibit, when one is held, and to make a report to the Association each year. The Secretary shall collect all moneys and turn them over to the Treasurer, from whom he shall receive a receipt for the same.

SEC. 8. The President shall appoint an auditing committee of three members, who shall audit the accounts of the Secretary and Treasurer each year.

SEC. 9. No obligation shall be incurred except by the Secretary, or in the absence of the Secretary, by the approval of at least five members of the Executive Committee.

SEC. 10. In case of the absence or disability of the Treasurer, the President shall sign checks for bills approved by the Secretary.

ARTICLE V.

DUES.

The expenses of the Association shall be borne by funds derived from the initiation fees, annual dues and sales of space at the exhibits.

The initiation fee of the Association shall be $25.00, payable within sixty days after election.

The annual dues shall be $25.00, $5.00 of which shall be payable to the American Foundrymen's Association by the Treasurer of the Foundry Supply Association, so that each firm, corporation or individual belonging to the Foundry Supply Association will also hold membership in the American Foundrymen's Association.

The annual dues shall be paid on or before the first of April of each year.

Each member shall be entitled to two representatives at the annual convention without extra compensation. If any member has more than two representatives at the convention, an additional fee of fifteen dollars ($15.00) shall be paid to the Treasurer for each such representative.

ARTICLE VI.

BADGES.

The members of the Association shall be provided with suitable badges to be worn at the convention, which badges shall be different from those worn by the members of the American Foundrymen's Association.

ARTICLE VII.

No firm or individual not a member of the Association shall be permitted to exhibit at the Annual Convention.

It is probable that in the December issue of THE FOUNDRY we will be able to publish plans of the armory in which the exhibit will be held, and considerably more information concerning the organization and the convention. It will undoubtedly be of interest to all engaged in the foundry supply business to know that applications have already

been received for quite a number of exhibit spaces, and the exhibit of foundry equipment bids fair to surpass that held in Cleveland.

PERSONALS.

Patrick J. McGuire, superintendent at Bessemer for the United States Cast Iron Pipe & Foundry Co., has resigned, and his place has been taken by M. J. Hays, foreman of the casting department.

John A. McGregor has been made president of the Union Iron Works, San Francisco, Cal., filling the vacancy caused by the resignation of Robert Forsythe, former president. George Fredericks, vice president, has also resigned, but his successor has not yet been named. C. N. Champion, formerly assistant treasurer and secretary, has been made secretary and treasurer.

Samuel E. Fetter, formerly with the Union Switch & Signal Co. and the Westinghouse Machine Co., has been placed in charge of the foundries of the Carnegie Technical Schools, Pittsburg.

William H. Foster, secretary of the H. C. Chase Foundry Co., Chicago, Ill., was badly injured by a street car in that city Sept. 23. He suffered a fracture of the leg and several scalp wounds, lying unconscious for some time before being found, but he will recover.

Henry E. Pridmore, of Chicago, sailed for Europe on Oct. 6 on the steamship Mesaba, bound for London. He expects to be absent for about a month.

H. H. Campbell, of the Pennsylvania Steel Co., states that the proof sheets for the new edition of his work, "The Manufacture and Properties of Steel," have practically all been prepared and that the book will be published in the near future. The present edition is exhausted.

A. W. Slocum, formerly general superintendent of the National Car Wheel Co., Pittsburg, has been made superintendent of the Dickson Car Wheel Co.'s plant, now building, at Houston, Tex.

Edward A. Johnson has been made director of the foundry department of the Winona Technical Institute, at Indianapolis, Ind. Mr. Johnson had several years' experience along practical lines with the Twin City foundry at Minneapolis, and for the last two years has had charge of the foundry department of the University of Minnesota.

Frank H. Taylor has re-entered the service of the Yale & Towne Mfg. Co. He was formerly connected with this company as manager of their Philadelphia branch, which position he held for seven years. For the past six years he has been manager of the Westinghouse Electric & Mfg. Co., of Pittsburg. It is understood he is to become vice president of the Yale & Towne Mfg. Co., and also a director.

DEATHS.

Edward T. Fairbanks, superintendent of the foundry of the Fairbanks Co., Springfield, O., died suddenly on Sept. 28, of heart failure.

Benjamin F. Hetherington, president of the Hetherington & Berner Iron Works Co., died at Indianapolis, Ind., Sept. 16, at the age of 77. He was a native of England.

George W. Robertson, president of the Southard-Robertson Co., stove manufacturer, died at Peekskill, N. Y., Sept. 17, of paralysis. He was born in New York city, Oct. 19, 1838, and was educated at the Peekskill Military academy and the Charlotte university and had been a member of the New York legislature.

Charles R. Vandercook, who established the first stove foundry in Chicago, was run down and killed by a train in that city, Sept. 21. He was 87 years of age.

Chas. Behling, foundry foreman with the Lindemann & Hoverson Co., Milwaukee, Wis., died Oct. 3.

FIRES.

On Sept. 22 the foundry of J. B. Tardiff, at Plessisville, Quebec, was de-

stroyed by fire, resulting in a loss of $15,000, partly covered by insurance.

The building occupied by T. L. Clark & Co., Montreal, Canada, as a brass manufacturing plant, was damaged to the extent of $5,000 by fire on Sept. 21.

The brass foundry of Cook Bros., Traverse City, Mich., was destroyed by fire on Sept. 25, with a loss of $4,000, on which there was $1,250 insurance. The foundry will be rebuilt as soon as possible.

Fire in the brass foundry of the Kennedy Valve Works, Coxsackie, N. Y., on Sept. 15, caused considerable damage to that department and also to the sand, coal and coke sheds. The loss is estimated to be about $8,000.

NEW CONSTRUCTION.

The Worcester Steel Foundry Co., Worcester and Millbury, Mass., is to erect an addition to its plant. Four new furnaces will be installed and it is the intention of the company to build another and larger extension to the works in the spring. Crucible steel castings are manufactured.

The Andrew Terry Co., Terryville, Conn., is building an addition to its foundry and will install a new air furnace.

The Fitchburg Foundry Co., Fitchburg, Mass., is shortly to make a large addition to its foundry on Water street, on land south of its present plant.

The Springfield Foundry Co., Springfield, Mass., is to erect a new foundry building to replace that recently destroyed by fire.

The Birmingham Iron Foundry, Derby, Conn., is adding a one-story structure to its present foundry building, which will serve as a new roll foundry, as it is the intention of the company to move that department from the main foundry to make room for other work. An additional cupola and a new 10-ton air furnace will be installed.

The Ireland Machine Co., Norwich, N. Y., has purchased a tract of land on State street on which it will erect a foundry of concrete construction. The plant will be equipped with modern machinery and will contain an electric light plant.

The Barcalo Mfg. Co., Buffalo, N. Y., has prepared plans for a new foundry building.

William Sellers & Co., Inc., will erect a two-story addition, at a cost of $4,000, to their foundry and pattern shop at Sixteenth and Buttonwood streets, Philadelphia.

The United States Furnace & Foundry Co., Darlington, Pa., with general offices at Pittsburg, may erect a plant at Niles, Mich., through the efforts of the Business Men's Association of that city.

The Johnstown Foundry, Machine & Car Co., Johnstown, Pa., has been purchased by George P. Suppes and his son, George O. Suppes, and the name will be changed to the Suppes Forge & Foundry Co., with George O. Suppes as manager. The plant makes a specialty of mine car parts, besides doing a general foundry jobbing business.

The Pittsburg Valve & Fittings Co., Barberton, O., expects to have its new malleable iron foundry completed by Dec. 1, when 500 additional men will be employed.

The Hance Casting Co., formerly of Columbus, O., has its new foundry at Plain City, O., in full operation, doubling its former capacity for custom foundry work, gray iron and semi-steel castings.

The American Roll & Foundry Co., Canton, O., recently incorporated with a capitalization of $200,000 is to erect a plant consisting of steel buildings, iron roof and brick and glass walls. This will include a main foundry building 60 x 160 feet, with a 30-foot lean-to, a main machine shop building, 60 x 140 feet, with a 30-foot lean-to, and a brick power house, 38 x 50 feet. Two air furnaces and a cupola will be installed. The Garrett-Cromwell Engineering Co., Cleveland, O., is engineer of the plant. Officers have

been elected as follows: J. B. Baird, president; William Gardner, vice president; Ed. Langenbach, treasurer, and David B. Day, secretary.

The Buckeye Foundry Co., Cincinnati, O., is planning to erect a one-story building, to be used for cleaning purposes.

The Kenton Hardware Mfg. Co., Kenton, O., is planning the erection of a one-story brick foundry building.

The Vulcan Foundry Co., Hartwell, near Cincinnati, O., has taken out a permit for the erection of a three-story concrete pattern shop.

The Eagle Foundry, Gray Iron & Brass Plating Co. has begun operations in the plant formerly occupied by the Indiana Bridge Co., Muncie, Ind.

The new foundry of the P. H. & F. M. Roots Co., Connersville, Ind., manufacturer of positive pressure foundry blowers, is practically completed, and will double the company's capacity.

The Wooley Foundry & Machine Works, Anderson, Ind., is to enlarge its capacity in the near future by the erection of a large building to be used for testing and assembling purposes.

The contract for constructing the new plant of the Langsenkamp Bros. & Wheeler Co., Indianapolis, Ind., has been awarded to the Carey Construction Co., of Cleveland.

The Geneva Foundry & Machine Co., Geneva, Ill., has recently completed some improvements to its plant, including the installation of new machinery, which will enable it to increase its working force.

The Angell Water Heating Co., through J. E. Angell, has purchased a tract of land in East St. Louis, Ill., on which it will erect a $15,000 foundry building.

The Root & Van Dervoort Engineering Co., Moline, Ill., has increased its capital stock from $125,000 to $250,000, and will make extensive additions to its plant.

Winslow Bros. & Co. will erect a one-story brick addition to their foundry at 2487-2489 West Harrison street, Chicago.

The Joliet Mfg. Co., Joliet, Ill., will double its capacity by additions to its machine shop and foundry.

The DeLoach Mill Mfg. Co., Atlanta, Ga., has purchased the old plant of the United States Pipe Works, at Bridgeport, Ala., which consists of a foundry building and pattern shop. Two new buildings, including a blacksmith shop and machine shop, will be added and considerable new equipment installed.

The Cape Breton Foundry Co. has begun the construction of its plant at Sydney, N. S.

The Prescott Co., Menominee, Mich., is to increase its plant by a brick and steel addition covering 14,400 square feet. Both iron and steel castings will be made, with a daily output of 25 tons. The company recently completed extensive additions.

The Milwaukee railroad is about to expend an additional $200,000 on its locomotive shops in Milwaukee, to increase the output from 60 to 130 engines a year. It has spent over $2,000,000 on the West Milwaukee shops in the last two years and has increased the car-wheel foundry output from 200 to 600 wheels per day.

The Gerson-Carey Co., Lansing, Mich., has moved its brass foundry equipment into its new plant and the output of the company will be considerably increased. A machine shop has been added to the plant.

The Clyde Iron Works, Duluth, Minn., has purchased a tract of land on which it will erect one of the largest foundries and machine shops in the northwest.

Work on the new foundry of the Covell plant, at Benton Harbor, Mich., is progressing rapidly.

The Fairbanks-Morse Mfg. Co., Beloit, Wis., is adding a building 75 x 300 feet, to its present plant.

The Oscar Barnett Foundry Co., Newark, N. J., states that nothing definite has yet been decided in regard to the erection of the new plant recently reported, though the matter is under discussion.

The Standard Cast Iron Pipe & Foundry Co., lately incorporated with a capital of $2,000,000, has purchased a tract of 30 acres in Bristol, Pa., and will establish a plant in which several hundred men will be employed.

The Marion Foundry & Machine Works, Marion, Va., has been incorporated with a capital stock of $30,000 by B. F. Buchanan, John S. Apperson, W. F. Culbert and R. A. Anderson. This company will succeed the Marion Mfg. & Milling Co., organized in 1901 for the manufacture of stoves, castings and farm implements.

The Southern Steel Co. is now occupying its new offices in the Brown-Marx building, Birmingham, Ala.

The Hicks Gas Motor Co., Waycross, Ga., manufacturer of gas engines and gas producers, has begun the erection of additional buildings to its plant, including a foundry and machine-erecting shop.

The new plant of R. W. Whitehurst & Co., Norfolk, Va., manufacturing agricultural implements, is now practically completed. It includes a foundry, factory building, pattern storage house, boiler rooms, engine room, etc. The latest improved machinery will be installed.

The Coosa Pipe & Foundry Co., Gadsden, Ala., is building an addition to its pipe-fitting department 75 x 175 feet.

M. A. Roach has purchased land in South Norfolk, Va., on which he is planning to erect a large iron foundry.

J. H. Bruns, of Madison, S. D., has secured a site at Watertown, S. D., for the erection of an iron foundry. The manufacture of gasoline engines will probably be taken up later.

Contracts for the new car-wheel plant of the Dickson Car Wheel Co., Houston, Tex., have been let. The plant includes a main foundry building, 135 x 264 feet, core room, power plant and storage building, and will have a capacity of 400 car wheels per day. The company intends to erect machine shops and general foundry later.

The Hiett Plow Co., Dryden, Ark., which was recently incorporated, will manufacture the line of Hiett agricultural implements heretofore made at Jonesboro, Ark. Two manufacturing buildings are in course of construction.

F. N. Delanoy is erecting a foundry in Alameda, Cal., for the manufacture of plumbers' specialties

The plant of the La Grange Foundry Co., La Grange, Mo., which is a branch of the Gardner Governor Co., Quincy, Ill., is now in operation.

The Crude Oil Power Co., Kansas City, Mo., is building a large plant for the manufacture of its portable refiners and crude oil engines, including a malleable iron and steel foundry, and expects to be in operation by Jan. 1, 1907. The foundry will at first produce about 30,000 pounds of steel castings per day, but will be large enough to double this capacity later, if necessary. A similar plant is being constructed at Sour Lake, Tex. The officers of the company are: G. W. Fitzpatrick, president; E. E. Richardson, vice president; W. C. Howe, treasurer, and A. A. Osborn, secretary and manager.

The Steel Safe Mfg. Co., Spokane, Wash., has purchased a site on which it will erect a plant for the manufacture of safes. A foundry will be included.

The Webb City Iron Works, Webb City, Mo., expects to have its new plant in operation about Dec. 1, employing 150 men.

The Smith's Falls Malleable Castings Co., Ltd., Smith's Falls, Ont., has purchased a site of 12 acres on the Rideau river and will erect a plant duplicating its present one, and will equip it in the most modern manner for the production of malleable and steel castings. Several hundred men will be employed. William H. Frost, of Smith's Falls, Ont., is president.

The Torreon Iron Works, Torreon, Mexico, will soon begin the erection of a foundry building, 60 x 120 feet, which will be equipped with the most modern appliances for handling heavy work.

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45,000

Barrels Flour

in the past twelve months

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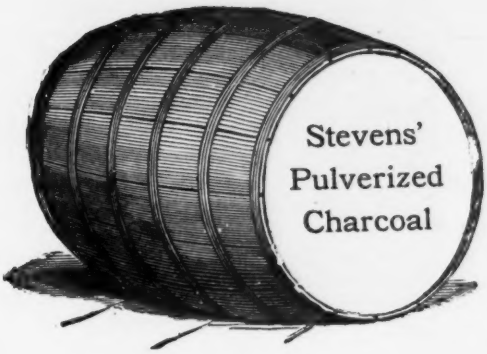

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Absolutely pure, bolted fine to an impalpable dust, goes through any shaking bag and leaves no shakings.

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I manufacture the entire line of Polishing Compositions and Foundry Facings and Supplies.

Samples submitted by express prepaid or goods shipped subject to approval.

The risk is mine.

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Cor. Larned and Third Sts.

DETROIT, MICH.

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Norton Company, Worcester, Mass.

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Analysis—Chemical:
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Ajax Metal Co., Birmingham, Ala.

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Connersville Blower Co., Connersville, Ind.
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Monarch Engineering & Mfg. Co., Baltimore.
Paxson Co., J. W., Philadelphia.
Roots Company, P. H. & F. M., Connersville, Ind.
Sturtevant Co., B. F., Boston.

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Connersville Blower Co., Connersville, Ind.
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Roots Company, P. H. & F. M., Connersville, Ind.
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Gautier & Co., J. H., Jersey City.

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Shelton Metallic Filler Co., Derby, Conn.
Shanafelt Mfg. Co., Canton, O.
Smooth-On Mfg. Co., Jersey City.

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Lindsay & Co., W. W., Philadelphia.
Shanafelt Mfg. Co., Canton, O.
U. S. Chaplet Co., New York.

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Surplus Coke Co., New York.

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Mills Oil Co., C. E., Syracuse.
National Jeloluse Co., New York.
Robeson Process Co., Camden, N. J.
Sterling Oil Co., Emlenton, Pa.

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Jones & Atwood, Stourbridge, Eng.
Kent Mfg. Co., Kent, O.
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Cost Keeping Systems.
Gunn, Richards & Co., New York.
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Curtis & Co. Mfg. Co., St. Louis, Ill.
Manning, Maxwell & Moore, New York.
Maris Bros., Philadelphia.
Niles-Bement Pond Co., New York.
Northern Engrng. Works, Detroit.
Pawling & Harnischfeger, Milwaukee.
Ridgway & Son, Craig, Coatesville, Pa.
Sellers & Co., William, Inc., Philadelphia.
Whiting Foundry & Equipment Co., Harvey, Ill.

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A Man's Stomach and a Furnace

are alike in that neither works well when the lining is out of order, and the cost of repair is a large item in each case. About the lining of your stomach see your doctor, but for your furnace lining get

COLLIAU CUPOLA BLOCKS.

The toughest, most refractory, most durable, and most economical block on the market; outwears every other lining. Made to fit any cupola and all sizes in stock.

How about Smooth-Faced Castings?

That's something you've been longing for, for some time, no doubt. Within easy reach now, just send for **Stevens' Carbon Blacking** This is a blacking that remains in solution—is more easily applied—saves time in finishing—gives a **smoother** and **more perfect finish** than any other blacking. A trial will prove the truth of these claims. Try it now—**today**. For use wherever a "wet blacking" is used—on Loam or Dry Sand Molds and as a Core Wash.

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Reduces cost, lessens loss, improves quality—the net result is pleased customers, a good asset for any foundry. STEVENS' GENUINE EAST INDIA PLUMBAGO goes farther and produces better results than any other. One cask convinces. "Everything for a Foundry." All goods of quality.

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Manufacturer

Cor. Larned and Third Sts.

Detroit, Mich.

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Fair, Taylor & Co., San Francisco.
Gautier & Co., J. H., Jersey City.
McCullough-Dalzell Crucible Co., Pittsburg.
Monarch Engineering & Mfg. Co., Baltimore.
Paxson Co., J. W., Philadelphia.
Ross-Tacony Crucible Co., Philadelphia.
Seidel, R. B., Inc., Philadelphia, Pa.
Taylor, Robt. J., Inc., Philadelphia.

Cupolas:

Byram & Co., Detroit.
Gilmour, J., New York.
McCormick Co., J. S., Pittsburg.
Northern Engnrng Works, Detroit.
Paxson Co., J. W., Philadelphia.
Whiting Foundry Equipment Co., Harvey, Ill.

Cupola Linings:

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Paxson Co., J. W., Philadelphia.

Curbing (Foundry):

United States Steel Piling Co., Chicago.

Elevators:

Curtis & Co. Mfg. Co., St. Louis.
Ridgway & Son, Craig, Coatesville, Pa.

Engines (Gas):

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

Engines (Steam):

American Blower Co., Detroit.
Sturtevant Co., B. F., Boston.

Engineers (Foundry, Mech., Elec., &c.):

Dodge & Day, Philadelphia.
Hooper, Geo. K., New York City.
Lindsay & Co., W. W., Philadelphia.

Facings:

Dixon Crucible Co., Jos., Jersey City.
Hill & Griffith Co., Cincinnati.
R. MacKellar's Sons Co., Peekskill, N. Y.
McCormick Co., J. S., Pittsburg.
Obermayer Co., S., Cincinnati.
Paxson Co., J. W., Philadelphia.
Pettinos Bros., Bethlehem, Pa.
Smith Foundry Supply Co., J. D., Cleveland.
Stephens & Co., Kidwelly, Eng.
Stevens, F. B., Detroit.
Western Foundry Supply Co., E. St. Louis, Ill.

Fans:

American Blower Co., Detroit.

Ferro-Manganese:

Kendall & Flick, Washington, D. C.
Rogers, Brown & Co., Cincinnati.

Ferro-Silicon:

Roessler & Hasslacher Chemical Co., New York.
Rogers, Brown & Co., Cincinnati.

Fillers (Metallic):

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Shanafelt Mfg. Co., Canton, O.
Shelton Metallic Filler Co., Derby, Conn.
Smooth-On Mfg. Co., Jersey City.

Fillets:

Cleveland Fillet Co., Cleveland, O.
Shanafelt Mfg. Co., Canton, O.

Fire Brick:

Gautier & Co., J. H., Jersey City.
Maurer & Son, Henry, New York.
Paxson Co., J. W., Philadelphia.

Fire Sand:

Carborundum Co., Niagara Falls, N. Y.

Flasks:

Adams Co., Dubuque, Ia.
Barnett Fdy. Co., Oscar, Newark.
Brass Founders' Supply Co., Newark.

Flasks (Snap):

Adams Co., Dubuque, Ia.
Diamond Clamp & Flask Co., Richmond, Ind.
Obermayer Co., S., Cincinnati.
Paxson Co., J. W., Philadelphia.

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Piqua Flour Co., Piqua, O.

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Barnett Fdy. Co., Oscar, Newark.
Etting, Edward J., Philadelphia.
Obermayer Co., S., Cincinnati.
Pangborn Co., Thos. W., New York.
Sly, W. W. Mfg. Co., Cleveland.
Stevens, F. B., Detroit.
Taylor, Robert J., Inc., Philadelphia.
Wiener Co., Ernest, New York.

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Hill & Griffith Co., Cincinnati.
McCormick Co., J. S., Pittsburg.
Obermayer Co., S., Cincinnati.
Osborn Mfg. Co., Cleveland.
Pangborn Co., Thos. W., New York.
Paxson Co., J. W., Philadelphia.
Shanafelt Mfg. Co., Canton, O.
Smith Foundry Supply Co., J. D., Cleveland.
Stevens, F. B., Detroit.
Taylor, Robert J., Inc., Philadelphia.

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Monarch Engineering & Mfg. Co., Baltimore.
Paxson Co., J. W., Philadelphia.
Rockwell Engineering Co., New York.

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Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Norton Co., Worcester.
Ransom Mfg. Co., Oshkosh, Wis.

Grinding Wheels:

Norton Co., Worcester.

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The Cost of It

The expense of a modern system of cost-keeping need be no greater than a crude, antiquated and inefficient way of keeping accounts.

Such a system is accurate, quick and in ample detail, and it gives the detailed costs of every part of the work while the business is fresh—when it is most valuable as a basis of comparison.

We have studied cost-keeping very carefully and have installed systems which meet these requirements in many well-known foundries.

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GUNN, RICHARDS & COMPANY

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50 CONGRESS STREET, BOSTON

224 ST. JAMES STREET, MONTREAL

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American Blower Co., Detroit.
Sturtevant Co., B. F., Boston.

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Curtis & Co., Mfg. Co., St. Louis.
General Pneumatic Tool Co., Montour Falls. N. Y.
Harrington Son & Co., Edwin, Philadelphia.
Niles-Bement-Pond Co., New York.
Northern Engrg. Works, Detroit.
Pawling & Harnischfeger, Milwaukee.
Sellers & Co., Inc., William, Philadelphia.
Whiting Fdy. Equipment Co., Harvey, Ill.
Yale & Towne Mfg. Co., New York.

Hoists (Pneumatic):

Ridgway & Son, Craig, Coatesville, Pa.

Hydrofluoric Acid:

General Chemical Co., Philadelphia.

Industrial Ry. Equipment:

Atlas Car & Mfg. Co., Cleveland.
The Gregg Company, Ltd., Newburg, N. Y.
Wiener Co., Ernest, New York.

Iron Ore:

Rogers, Brown & Co., Cincinnati.

Lacquers:

New Era Lustre Co., New Haven.

Ladles:

Northern Engrg. Works, Detroit.

Molding Machines:

Adams Co., Dubuque, Ia.
Arcade Manufacturing Co., Freeport, Ill.
Berkshire Mfg. Co., Cleveland.
Herman Pneumatic Machine Co., Zelienople, Pa.
Manning, Maxwell & Moore, New York.
Maywood Foundry & Machine Co., New York.
Mumford Co., E. H., Philadelphia.
Paxson Co., J. W., Philadelphia.
Pridmore, Henry E., Chicago.
Tabor Mfg. Co., Philadelphia.
Turner Machine Co., Philadelphia.

Oil (Linseed):

Holland Linseed Oil Co., Chicago.

Pattern Letters:

Shanafelt Mfg. Co., Canton, O.

Packing (Rubber Sheet):

Smooth-On Mfg. Co., Jersey City.

Parting Materials:

Foundy Specialty Co., Cincinnati.
Partamol Co., New York.

Patterns (Metal & Wood):

Herman Pneumatic Machine Co., Zelienople, Pa.

Pattern Shop Equipment:

Fox Machine Co., Grand Rapids, Mich.

Phosphorizers:

McCullough-Dalzell Crucible Co., Pittsburg.

Phosphor Tin:

Crescent Phosphorized Metal Co., Philadelphia.
New Era Mfg. Co., Kalamazoo.

Pig Iron:

Addy & Co., Mathew, Cincinnati.
Baird & West, Detroit.
Bartlett & Co., N. S., Boston.
Cherry Valley Iron Co., Pittsburg.
Columbus Iron & Steel Co., Columbus.
Dalton, Nash & Co., New York.
De Camp Bros. & Yule, St. Louis.
Dimmick & Co., J. K., Buffalo.
Domhoff & Joyce Co., Cincinnati.
Elliott, Debevoise & Anderson, New York.
Field Sales Agency, Robert, Cincinnati.
Goodrich & Co., F. A., Detroit.
Hillman & Son, J. H., Pittsburg.
McKeefrey & Co., Leetonia, O.
Mohr, J. J., Philadelphia.
Pickands, Brown & Co., Chicago.
Pickands, Mather & Co., Cleveland.
Pilling & Crane, Philadelphia.
Rogers, Brown & Co., Cincinnati.
Shepard, Chas. G., Buffalo.
Stevens, F. B., Detroit.
Thomas Furnace Co., Milwaukee.
Walter-Wallingford & Co., Cincinnati & Pittsburg.

Plumbago:

Dixon Crucible Co., Jos., Jersey City.
Gautier & Co., J. H., Jersey City.
Hill & Griffith Co., Cincinnati.
McCullough-Dalzell Crucible Co., Pittsburg.
Obermayer Co., S., Cincinnati.
Pettinos Bros., Bethlehem, Pa.
Ross-Tacony Crucible Co., Philadelphia.
Stevens, F. B., Detroit.

Polishers' & Platers' Supplies:

Stevens, F. B., Detroit.

Riddles:

Adams Co., Dubuque, Ia.
U. S. Chaplet Co., New York.

Sand:

Dresden Sand Co., Dresden, O.
Paxson Co., J. W., Philadelphia.
Pangborn Co., Thos. W., New York.
Standard Sand & Machine Co., Cleveland.
Stevens, F. B., Detroit.

Sand Blast Machinery:

Drucklieb, C., New York.
Pangborn Co., Thos. W., New York.
Paxson Co., J. W., Philadelphia.
Tilghman-Brooksbank Sand Blast Co., Philadelphia.

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